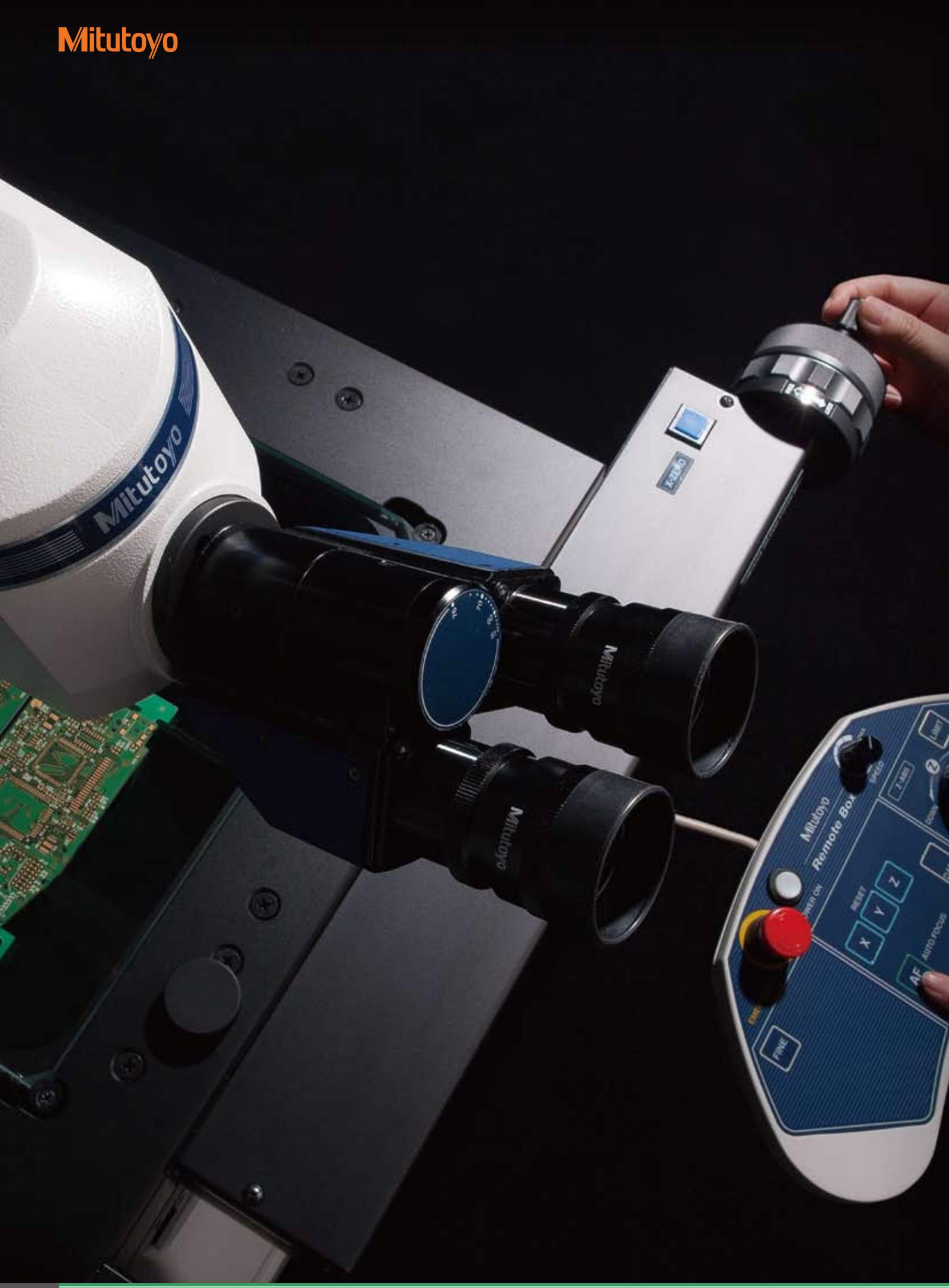
Mitutoyo

Mitutoyo Corporation
80th Anniversary
Since 1934

Measuring Microscopes
MF/MF-U Series

Optical Measuring

Catalog No. E14003(3)


Mitutoyo
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Remote Box
RESET
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AUTO FOCUS
FINE

Expectations for Measuring Microscopes

A measuring microscope can be used to perform both measurement and observation, inspecting a variety of objects including semiconductors, electronic and electrical components, automobile precision components, resin moldings, tools, and medical products. For example, this type of microscope can be used to measure an object that is too soft for contact measurement or the diameter of a hole that is too small for a measurement probe to contact.
A balance between optical performance, overall accuracy, and ease of use is an important requirement for a measuring microscope. A measuring microscope enables you to observe elements that have either been invisible or difficult to see and measure them. Mitutoyo believes that expectations for measuring microscopes will continue to grow and that user friendliness, high measurement data throughput, and environmental friendliness will be demanded at the same time. To play our part in supporting essential technologies in the industry, we will continue to provide high-quality, high-definition measuring microscopes, while staying true to our commitments and beliefs.

From Design and Development to Support after Delivery

Mitutoyo designs, develops and manufactures all microscope parts – including those for the body, such as the lenses and optical tube – and the highly accurate built-in digital scale. Our in-house design and development processes allow us to, proactively, offer consultation on special requirements and respond to customer requests, such as those for customized fabrication.
Mitutoyo carefully delivers the microscope from the production plant to its desired destination*, and then installs and adjusts it there. The packaging box is recyclable, which enables the customer to eliminate as much waste as possible at the delivery destination. After adjustment, customers can sign a maintenance contract or use our reliable after-sales services according to their needs, which ensures that they can confidently use their Mitutoyo microscope for a long time to come.

*If a dedicated delivery service is used.

Lineup

High accuracy measurement, improved operability and a choice of models to suit practically any application. Lineup now includes motor-driven Z-axis models.

Standard models

Mitutoyo's quick release mechanism on the X and Y axes allows fast stage movement and easy positioning while keeping both hands on the control handles.

Measuring Microscope
MF Series

Measuring Microscope
MF-U Series

Motor-Driven Z-axis Models

NEW Products

Stage operation for the X and Y axes is unchanged but the motorized Z-axis provides comfortable operation and enables dynamic up/down operation with a jog shuttle as well as accurate fine-focusing control.

Motor-Driven Z-axis
Measuring Microscope
MF Series

Motor-Driven Z-axis
Measuring Microscope
MF-U Series

Motor-Driven X/Y/Z-axes Models

Motorized X, Y, and Z axes allows easy stage movement and focus adjustment and eliminates operator fatigue.

Motor-Driven
Measuring Microscope
MF Series

Motor-Driven
Measuring Microscope
MF-U Series

Motor-Driven
Measuring Microscope
MF-U Series (LAF model)

CONTENTS

Measuring Microscopes
MF series

Features ——— P8 - 11
Specifications ——— P12 - 13
Dimensions ——— P16
System Diagrams ——— P18

Universal Measuring Microscopes
MF-U series

Features ——— P8 - 11
Specifications ——— P14 - 15
Dimensions ——— P17
System Diagrams ——— P19

Motor-Driven Z-axis Measuring Microscopes
MF series/MF-U series

Features ——— P20 - 22
Specifications ——— P23 - 24
Dimensions ——— P25
System Diagrams ——— P34 - 35

Motor-Driven Measuring Microscopes
MF series/MF-U series

Features ——— P26 - 29
Specifications ——— P30 - 31
Dimensions ——— P32 - 33
System Diagrams ——— P34 - 35

Options

Objectives ——— P36 - 37
Illumination ——— P38 - 39
Manual Image Measurement Vision Unit ——— P40
2-D Data Processing Unit QM-Data200 ——— P41
Focus pilot, Sliding Nosepieces and Turrets ——— P43
Rotary table with fine feed wheel, V-block with clamp, Swivel center support, Holder with clamp and Stage adapter ——— P44
Polarization unit, Differential interference contrast unit, Illumination filter, C-mount adapter, 0.5X TV adapter and Stage micrometer — P45
Mounting stand, Vibration damping stand and Lens cleaning set — P46
Reticle ——— P47

In Pursuit of Optical Performance — The Essence of Microscopy —

These microscopes use an optical design for the optical tube and objective to reduce flare within the optical system as much possible and so enable the clear display of subtle details of inspected objects. With this series, even the surface of black resin can also be clearly observed in high contrast. The MF-U Series is equipped with the proven FS optical system metal microscope head and displays clear images with high color reproducibility in which the three prime colors are corrected. (The plan apochromat specifications are used for the objective*.)
For the MF and MF-U Series, an LED- or halogen-based lighting system can be used. Higher lighting efficiency and sufficient illuminance within the optical system provide an environment for high-magnification measurement and bright-field and dark-field observation in which you can work efficiently without getting tired.

* Specifications according to which aberrations across the image surface and chromatic aberrations in the wave length range of the three primary colors (blue, yellow and red) are corrected.

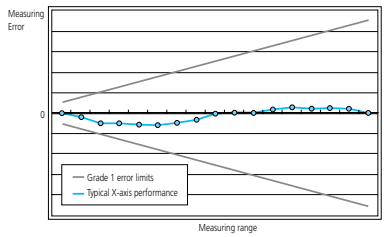
In Pursuit of Measuring Accuracy — Close to JIS Grade 0 —

(Common to MF D and MF-U D)

X and Y axes: (2.2+0.02L) µm or less

Reference) Measuring accuracy of each axis of a JIS B 7153 measuring microscope (at 20°C)
Grade 0: (2+0.01L)µm or less
Grade 1: (4+0.02L)µm or less L: measuring length (mm)

Example



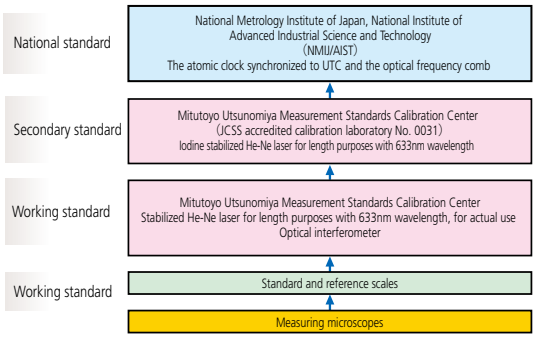
A measuring microscope must have high level optical performance and overall measuring accuracy. The MF and MF-U Series realizes the measuring accuracy stipulated by the above standards for every stage size*. This series is useful for any measurement because it offers both long stroke measurement and high accuracy at the same time.

*Conforms to the JIS B 7153 measurement method for the X and Y axes. The above measuring accuracy graph is an example and does not represent all main unit accuracies.

The digital scale built into the microscope is a photoelectric type transmission linear encoder with a maximum response speed of 50m/min. This highly accurate encoder was developed in an underground laboratory where the world's best scale accuracy evaluation technique is available.
Mitutoyo was the first manufacturer to acquire ISO/IEC 17025(JCSS) accreditation for calibrating line standards (standard scales up to 500mm long) in Japan.

For Safe Use — Traceability to National Standards —

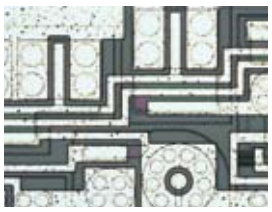
To establish and maintain the traceability of measuring tools and instruments, Mitutoyo uses length standards traceable to the national standards in Japan to calibrate the standard used to calibrate measuring tools and instruments.


National standard
National Metrology Institute of Japan, National Institute of Advanced Industrial Science and Technology (NMIJ/AIST)
The atomic clock synchronized to UTC and the optical frequency comb
Secondary standard
Mitutoyo Utsunomiya Measurement Standards Calibration Center (JCSS accredited calibration laboratory No. 0031)
Iodine stabilized He-Ne laser for length purposes with 633nm wavelength
Working standard
Mitutoyo Utsunomiya Measurement Standards Calibration Center
Stabilized He-Ne laser for length purposes with 633nm wavelength, for actual use
Optical interferometer
Working standard
Standard and reference scales
Measuring microscopes

Solutions Provided by Measuring Microscopes

Observation and Inspection of Small Areas

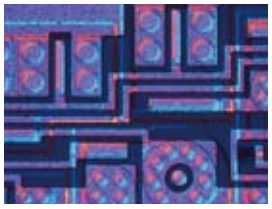
By using various modes of illumination, the MF Series can more precisely reproduce the colors and shapes of objects that are observed and inspected.
The MF-U Series microscopes are high value-added instruments that offer microscope observation functions such as dark-field mode (to observe surface scratches and small steps, which are difficult to see in bright-field mode), simple polarization (to observe coloration or contrast through the polarizer or analyzer using polarization properties), and differential interference (to observe small surface steps and other elements in color contrast using a polarizing filter with a differential interference prism), as well as measurement functions.



Bright-field observation

Dark-field observation

Polarized observation



Differential interference observation

Easy Image Photography

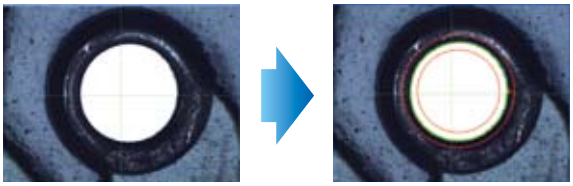
Anyone can easily photograph microscope images by attaching a digital camera to the microscope. Because a general-purpose C-mount adapter is used, any digital camera model that supports C-mounting can be attached. For example, several people can simultaneously analyze and evaluate the microscope image displayed on the monitor, or generation of an inspection chart attached to the image can be automated.

MF-B2017D + Vision Unit

Microscope-Based High-Resolution Measurement

It is possible to build a manual image measurement system by equipping a measuring microscope with the image measurement option (the Vision Unit). Because the software constantly transmits stage displacements, measurements within the camera imaging range (on the screen) as well as those wider than the screen are supported. In addition, automatic edge detection provides an efficient measurement environment with a high throughput.
However, eyepiece resolution might be superior to camera resolution in some cases. For example, the surface of a molded item made of black resin might be clearer to the naked eye than to the camera (monitor observation). Therefore, a measuring microscope that also enables you to see the surface and other elements is said to be a system that has a very high added value. It is recommended to connect the two-dimensional data processing unit QM-Data 200 (a dedicated control unit) to the measuring microscope for such dimensional measurement.

MF-UB1010D + QM-Data200



Measuring Microscopes MF Series
Universal Measuring Microscopes MF-U Series

New optional sliding nosepiece allows one of two objectives to be quickly moved into position to change the magnification, and a circular illuminator to be fitted. Operability has improved in this series by allowing freedom of mounting position for the digital display.

Sliding Nosepiece New design

(Factory-set option of **MF D**)

Sliding nosepiece with two objectives mounted.

Dedicated LED circular illuminator mounted on the sliding nosepiece.

The MF (finite correction optical system) measuring microscope usually only allows a single objective to be mounted which needs to be replaced for every magnification change. The new sliding nosepiece allows two objectives to be mounted, thus allowing quick magnification change. This nosepiece design also enables installation of an LED circular illumination unit. Thanks to these arrangements, a quick change of magnification and versatile illumination is supported.

High Visibility Digital Display

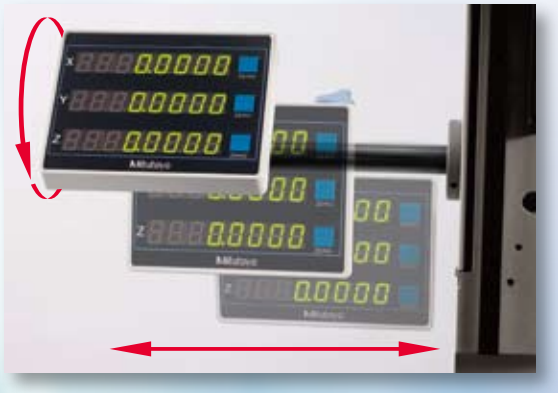
New design

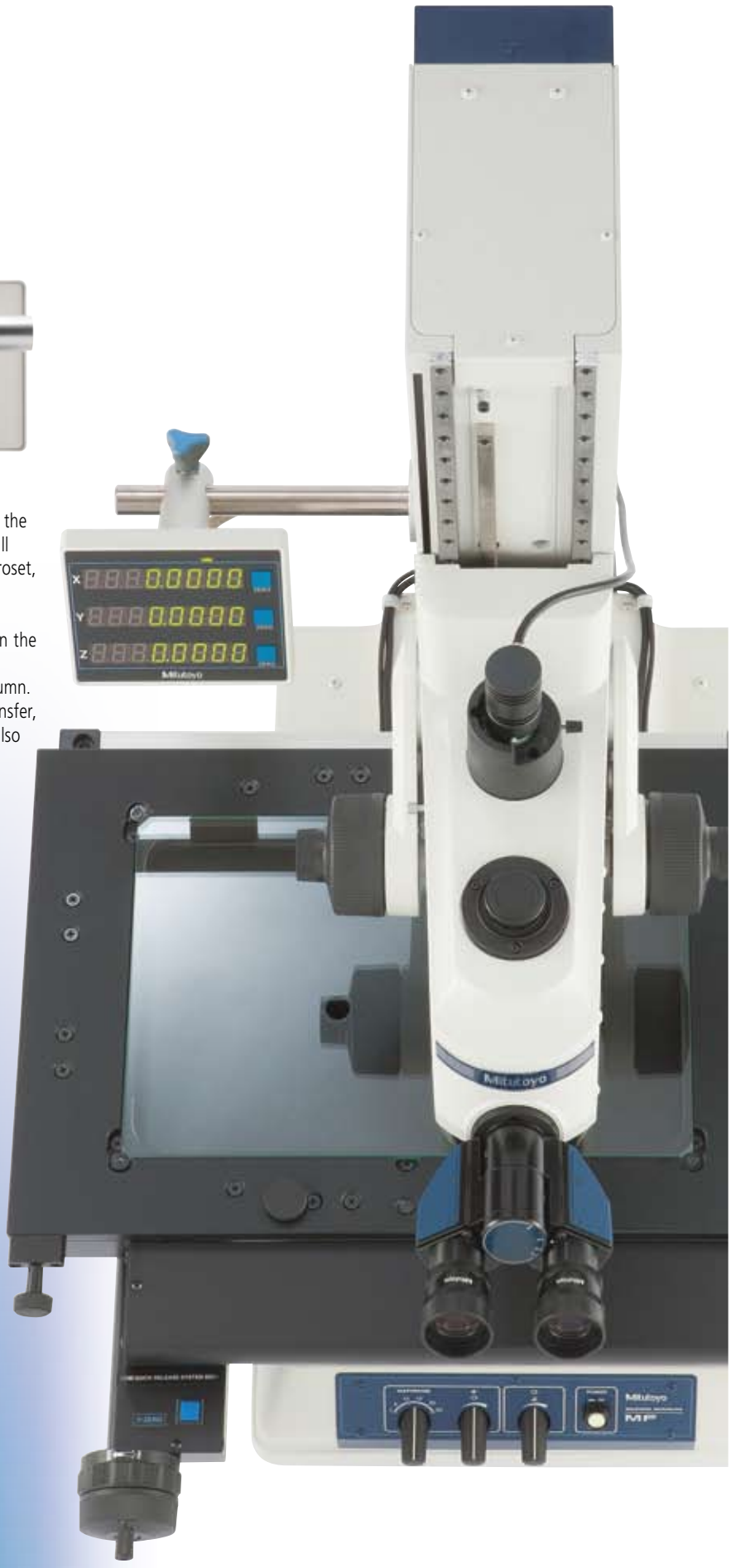
(Common to **MF D** and **MF-U D**)

Front of display

Rear of display

Because the resolution can be switched to 1µm, 0.5µm, or 0.1µm for the digital display (two or three axes), which is a standard accessory for all models, high-discrimination measurement can be performed. The zeroset, direction changeover, and smoothing functions are also standard.
(Zero can be set using the switch near the X or Y handwheels.)
The display is low-profile but has large digits and can be mounted in the position most convenient for the operator.
The digital display can be installed on the left or right side of the column.
Because the general-purpose RS-232C format is adopted for data transfer, data can be output to a standard printer or personal computer. It is also possible to output the display readings to spreadsheet software.



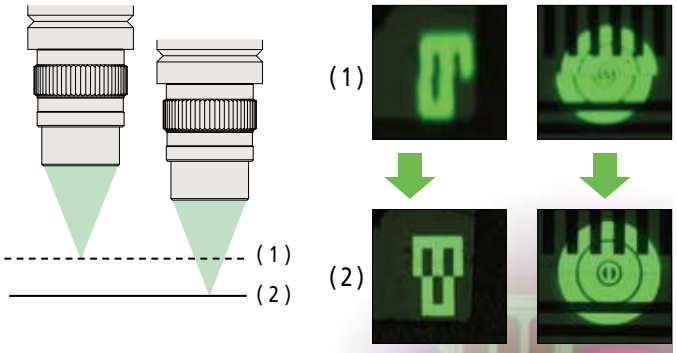


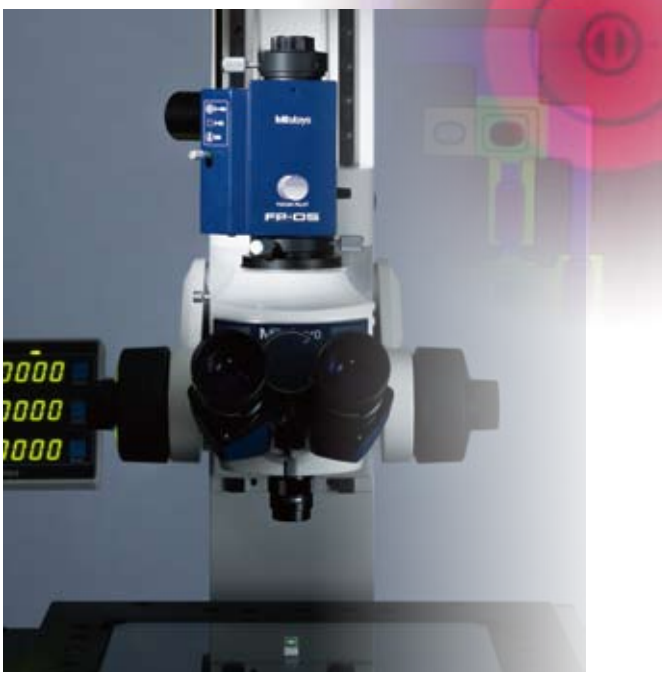
Measuring Microscopes MF Series
Universal Measuring Microscopes MF-U Series

Height Measurement with a High Focus Repeatability

(Option on **MF D** / factory-set option on **MF-U D**) For details, see page 42.

Focus repeatability is important when measuring a vertical step or other element using the microscope.
In particular, measurement errors due to the depth of focus of the objective are inevitable. The MF and MF-U Series measuring microscopes have a focus pilot, which enhances focus repeatability. The focus pilot is mounted on the TV camera port section in the main unit as an add-on unit and enables focusing position detection with high accuracy and repeatability. This realizes higher repeatability than a visual check and decreases variation in measured values caused by human error.
Two types of focus patterns are available, either of which can be selected according to the size of the part to be focused on or the surface state, material, or other properties of the inspected object. A clear, bright, high-intensity LED (green or red) is employed as the light source. The focus pattern, for which brightness can be steplessly adjusted, can be checked on the eyepiece or TV monitor. This substantially improves measurement throughput.

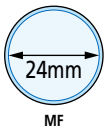




Wide-Field Observation

(Common to **MF D** and **MF-U D**)

The best-in-class eyepiece field number* of 24mm (for WF10X) offers a wide viewing field that helps prevent extended observation or measurement from affecting your eyes or causing fatigue. The WF10X eyepiece has wider diopter adjustment ranges on the left and right sides than older products.



* Width of an inspected object that can be seen across the whole viewing field when a 1X objective is used

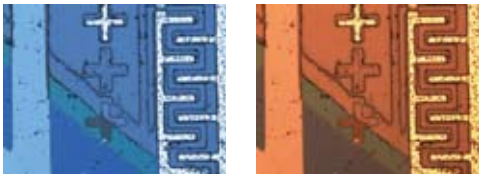
LED and Halogen Light Options for Transmitted and Reflected Illumination

(Options common and essential to **MF D/MF-U D**)

Transmitted LED illumination unit (Common to MF/MF-U Series) | Reflected LED illumination unit (for MF Series) | Reflected LED illumination unit (for MF-U Series)

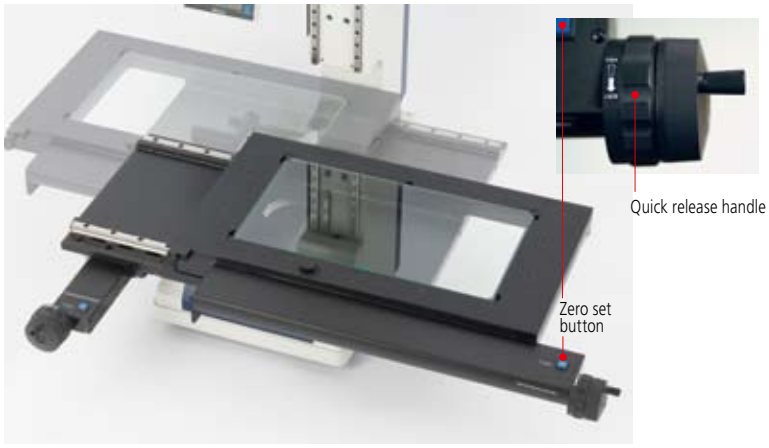
An LED or halogen light can be selected for the coaxial illumination in the main unit. While the conventional halogen light can be used for observation and measurement, the LED light can also be selected if you want to reduce the time lost to replace a failed halogen bulb with a new one and need high intensity illumination that quickly responds to brightness adjustment.
The LED light has a long working life*1 and will not suddenly fail.
In addition, the visibility, brightness and coloration are constant because, unlike fluorescent tubes, the LED light is free from glare and changes in color temperature. This means less eye fatigue after extended observation. Because the LED consumes little power and emits little heat radiation, measurement is economical and produces less heat-induced effects on inspected objects*2. In addition, this light source is impact resistant and does not contain environmental toxins.
All the models in the MF and MF-U Series have transmitted and reflected illumination aperture-diaphragms as standard to enable observation and measurement with less light diffraction.

*1: The working life will be shorter if the maximum illuminance is always used.
*2: The LED light for MF/MF-U D Series incorporates a quiet cooling fan to further reduce heat effects.



LED illumination | Halogen illumination

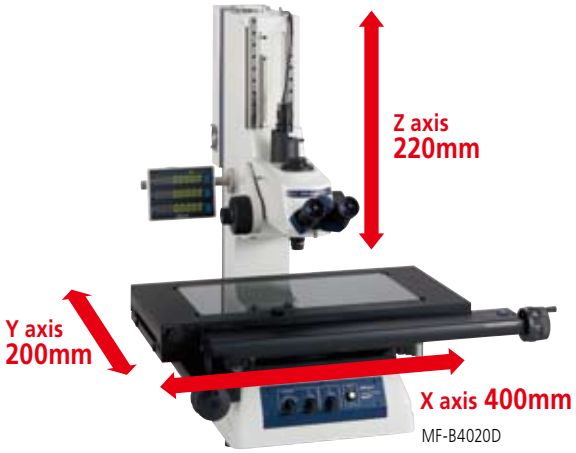
Quick Release Mechanism*1 and Zero-set Switch Incorporated*2 (Common to **MF D** and **MF-U D**)



The stage movement can be switched between extremely coarse and fine (FREE and LOCK) by using the quick release handles on the X and Y handles.
These handles are useful for freeing the stage when the distance to the measurement position is long or you want to quickly return to a reference position.
Because this mechanism uses the twist roller method, switching causes little impact and enables smooth movement. Because the display zero-set switches are located near the handles*2, you can focus on the eyepiece during measurement and keep your hand near the handle almost all the time except when adjusting the focus.

*1: Patent registered in Japan
*2: The zero-set buttons are located on the X and Y axes, not the Z axis.

Stage Variations Including Long Stroke
(Common to **MF D** and **MF-U D**)



Inspected objects vary in size.
Widely used in every industry, this series provides many measurement stroke variations.
This series offers a stage for long stroke measurement of 400×200×220mm in X, Y and Z. This is useful when measuring printed circuit boards, shafts, knife tools and other objects. Although the standard model has a Z-axis range of 220mm, the Z axis can be extended with a column upgrade.
A swivel rotation mechanism* is also provided as standard. This mechanism is useful when fixing an inspected object in parallel with the table movement direction.

*Only for models with a Y-axis range of 170mm or longer

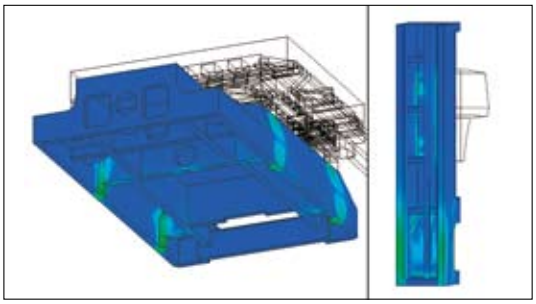
Z-Axis Handles Provided on Both Sides of Standard Model (**MF D** and **MF-U D**)

Because the Z axis handles are placed on both sides of the column in standard models, the user can easily use one of them regardless of handedness.
The digital display can also be installed on either side of the column to set up an environment suited to the user's dominant hand.
Ergonomics have also been taken into consideration, and the handle is located in a position where a user of shorter stature can comfortably turn it.

Tilting Optical Tube of Standard Model (**MF-U D**)

Comfortable observation is possible because the eye point can be adjusted to a position suitable for the user's stature.
The angle of the column can be fixed anywhere between 0° and 30°.
The reticle in the optical tube can be replaced.

Highly Rigid Column Base
(Common to **MF D** and **MF-U D**)



Column

The base that supports the column holding the optical tube and the rest of the microscope must be absolutely rigid to enable observation and measurement using any amount of magnification.
This series has been repeatedly evaluated from various aspects including a drop test*, transportation test*, and smoothing test and provides steady vision and consistent accuracy over the entire stroke.
To enhance rigidity, horizontal ribs have been added within the column. The power supply section is located outside the base to reduce heat effects for higher base rigidity and highly accurate measurement.

*Proprietary Mitutoyo tests executed using appropriate procedures.

Mitutoyo

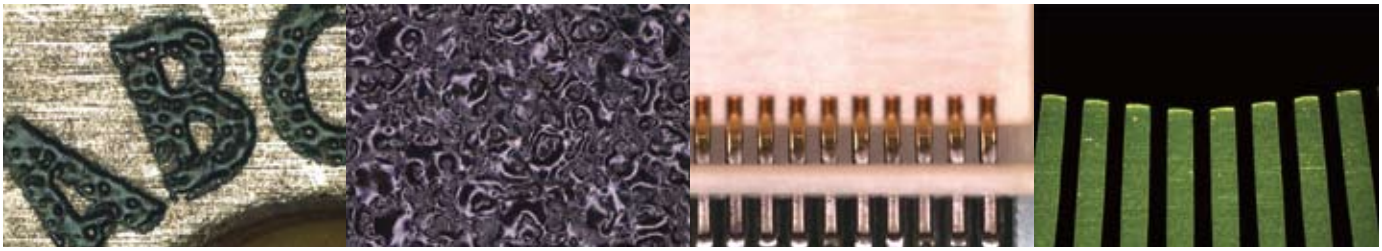
Measuring Microscopes
MF Series

MF-B1010D
* The binocular tube (eyepiece) and illumination unit are optional accessories.

MF-B2010D
* The binocular tube (eyepiece) and illumination unit are optional accessories.

Features

- Observation with a clear and flare-less erect image and a wide field of view
- Measuring accuracy that is the highest in its class (and conforms to JIS B 7153)
- ML series, high-NA objectives that are specially designed for the MF series (long working distance type)
- Illumination unit (reflected/transmitted) selectable from a high-intensity LED or halogen bulb (required)
- Variable aperture diaphragm (reflected/transmitted) allows adjustment for contrast and resolution
- Variety of standardized stages in sizes up to 400×200mm
- Quick-release mechanism useful for moving the stage quickly when measuring workpieces that are large in size or quantity
- Coarse/fine feed handles equipped as standard on both sides allow precise focus and observation measurement regardless of handedness
- High-magnification eyepiece observation up to 2000X
- Standard measuring microscope that has a wide variety of optional accessories including a Vision Unit and various digital CCD cameras
- Low-noise design



MF-B2017D
* The binocular tube (eyepiece) and illumination unit are optional accessories.

MF-B3017D
* The binocular tube (eyepiece) and illumination unit are optional accessories.

MF-B4020D
* The binocular tube (eyepiece) and illumination unit are optional accessories.

Specifications

Without Z-axis scale	**Model No.**	**MF-A1010D**	**MF-A2010D**	**MF-A2017D**	**MF-A3017D**	**MF-A4020D**
	Order No.	**176-861***	**176-862***	**176-863***	**176-864***	**176-865***
With Z-axis scale	**Model No.**	**MF-B1010D**	**MF-B2010D**	**MF-B2017D**	**MF-B3017D**	**MF-B4020D**
	Order No.	**176-866***	**176-867***	**176-868***	**176-869***	**176-870***
Optical tube (eyepiece(s) required)		Monocular or binocular (angle of column: 25°) Standard TV camera port for all models, reticle (broken cross-hair, line width: 5µm), optical path switching (observation/TV camera = 50/50)				
Observation image		Erect image				
Observation method		Bright-field observation				
Eyepiece (optional) Adjustable diopter		10X (eyepiece field number: 24), 15X, 20X Note: Monocular - one 10X eyepiece provided as standard; Binocular - two 10X eyepieces provided as standard				
Objective (optional)		ML objective 3X (provided as standard), 1X, 5X, 10X, 20X, 50X, 100X				
Z axis	Max. workpiece height	150mm		220mm		
	Feed mechanism	Coaxial coarse and fine feed, handles on both sides (coarse: 30mm/rotation, fine: 0.2mm/rotation)				
Illumination unit		LED or halogen is required.				
Illumination filter		One GIF filter is provided as standard (and mountable for both transmitted and reflected illumination)				
Stage	Measurement range	100×100mm	200×100mm	200×170mm	300×170mm	400×200mm
	Tabletop size	280×280mm	350×280mm	410×342mm	510×342mm	610×342mm
	Effective stage glass size	180×180mm	250×150mm	270×240mm	370×240mm	440×240mm
	Swiveling angle	—		±5° (left)		±3° (left)
	Maximum table loading	10kg		20kg		15kg
	Quick-release mechanism	Provided as standard for the X and Y axes				
	Zero-set button	Provided as standard for the X and Y axes (and for the Z axis only for the MF-B type)				
Measurement system		High-accuracy digital scale				
Measuring accuracy*1 (X and Y axes, when not loaded)		(2.2+0.02L)µm, L: measuring length(mm)				
Digital display	Minimum reading	1/0.5/0.1µm switchable				
	Display axes	X and Y (or X, Y, and Z only for the MF-B type)				
	Functions	Zero-setting, direction switching, RS232C output, USB output (specific to QSPAK)				
Main unit dimensions (WxDxH)		562×730×667mm	624×745×667mm	632×892×782mm	682×892×782mm	757×907×782mm
Main unit mass		67kg	71kg	148kg	156kg	162kg
Control unit dimensions and mass		114 W×360 D×96 H mm LED: 3.5kg/Halogen: 4kg				
Maximum power consumption (with the illumination unit)		LED: 45W Halogen bulb: 160W				

* The following suffixes are added to the order No. (e.g.: 176-861-10) to specify the User Manual's language: -10 for English; -11 for Chinese; No suffix for Japanese.
*1 Measured in conformance with JIS B 7153

Replacement halogen bulb (reflected/transmitted)	Standard: **513667** (12V/50W)
	Long life: **12BAB345** (12V/50W)

Mitutoyo

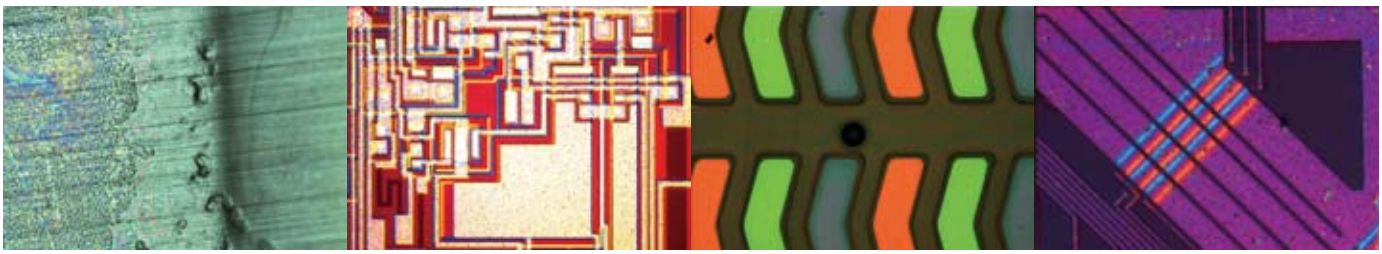
Universal Measuring Microscopes
MF-U Series

MF-UB1010D
* The turret, objectives and illumination unit are optional accessories.

MF-UB2010D
* The turret, objectives and illumination unit are optional accessories.

Features

- Observation with a clear and flare-less erect image and a wide field of view
- Measuring accuracy that is the highest in its class (and conforms to JIS B 7153)
- Proven M Plan Apo/BD Plan Apo/G Plan Apo series, high-NA objectives from the FS optical system (long working distance type)
- Integration of metallurgical and measurement microscope functions provides a high-resolution observation and high-accuracy measurement solution
- Illumination unit (reflected/transmitted) selectable from a high-intensity LED or halogen bulb (required)
  * Only the halogen light source for transmitted illumination is provided as standard accessory. A seperate light source for transmitted illumination must be ordered additionally as optional accessory.
- Variable aperture diaphragm (reflected/transmitted) allows adjustment for contrast and resolution
- Variety of standardized stages in sizes up to 400×200mm
- Quick-release mechanism useful for moving the stage quickly when measuring workpieces that are large in size or quantity
- Coarse/fine feed handles equipped as standard on both sides allow precise focus and observation measurement regardless of handedness
- High-magnification eyepiece observation up to 4000X (when using M Plan Apo SL200X)
- Standard measuring microscope that has a wide variety of optional accessories including a Vision Unit and various digital CCD cameras
- Low-noise design



MF-UB2017D

* The turret, objectives and illumination unit are optional accessories.

MF-UB3017D

* The turret, objectives and illumination unit are optional accessories.

MF-UB4020D

* The turret, objectives and illumination unit are optional accessories.

Specifications

BF (bright-field)	Without Z-axis scale	**Model No.**	**MF-UA1010D**	**MF-UA2010D**	**MF-UA2017D**	**MF-UA3017D**	**MF-UA4020D**
		Order No.	**176-871***	**176-872***	**176-873***	**176-874***	**176-875***
	With Z-axis scale	**Model No.**	**MF-UB1010D**	**MF-UB2010D**	**MF-UB2017D**	**MF-UB3017D**	**MF-UB4020D**
		Order No.	**176-876***	**176-877***	**176-878***	**176-879***	**176-880***
BD (bright-field/ dark-field)	Without Z-axis scale	**Model No.**	**MF-UC1010D**	**MF-UC2010D**	**MF-UC2017D**	**MF-UC3017D**	**MF-UC4020D**
		Order No.	**176-881***	**176-882***	**176-883***	**176-884***	**176-885***
	With Z-axis scale	**Model No.**	**MF-UD1010D**	**MF-UD2010D**	**MF-UD2017D**	**MF-UD3017D**	**MF-UD4020D**
		Order No.	**176-886***	**176-887***	**176-888***	**176-889***	**176-890***
Optical tube			Tilting trinocular tube (angle of column: 0 to 30°), Siedentoph type (pupil distance adjustment: 51 to 76mm), built-in 1X tube lens, reticle (broken cross-hair, line width: 5µm), optical path switching (observation/TV camera = 50/50)				
Observation image			Erect image				
Observation method			BF, DF (only for MF-UC and UD types), simple polarization, differential interference				
Eyepiece (optional) Adjustable diopter			10X (eyepiece field number: 24, two eyepieces provided as standard), 15X, 20X				
Turret (required)	Bright-field (BF)		Adjustable manual turret or adjustable power turret (Select one.)				
	Bright-field/dark-field (BD)		Adjustable manual turret or adjustable power turret (Select one.)				
Objective (optional)	Bright-field (BF)		All lenses including the M Plan Apo, M Plan Apo SL, and G Plan Apo series				
	Bright-field/dark-field (BD)		All lenses including the BD Plan Apo and BD plan Apo L series				
Z axis	Max. workpiece height		150mm		220mm		
	Feed mechanism		Coaxial coarse and fine feed, handles on both sides (coarse: 10mm/rotation, fine: 0.1mm/rotation)				
Illumination unit			LED or halogen is required.				
Illumination filter			One GIF filter is provided as standard (and mountable for both transmitted and reflected illumination)				
Stage	Measuring range		100×100mm	200×100mm	200×170mm	300×170mm	400×200mm
	Tabletop size		280×280mm	350×280mm	410×342mm	510×342mm	610×342mm
	Effective stage glass size		180×180mm	250×150mm	270×240mm	370×240mm	440×240mm
	Swiveling angle		—		±5° (left)		±3° (left)
	Maximum table loading		10kg		20kg		15kg
	Quick-release mechanism		Provided as standard for the X and Y axes				
	Zero-set button		Provided as standard for the X and Y axes (and for the Z axis only for the MF-UB and -UD types)				
Measurement system			High-accuracy digital scale				
Measuring accuracy*1 (X and Y axes, when not loaded)			(2.2+0.02L)µm, L: measuring length(mm)				
Digital display	Minimum reading		1/0.5/0.1µm switchable				
	Display axes		X and Y (or X, Y, and Z only for the MF-UB and -UD types)				
	Functions		Zero-setting, direction switching, RS232C output, USB output (specific to QSPAK)				
Main unit dimensions (WxDxH)			562×730×667mm	624×745×667mm	632×892×782mm	682×892×782mm	757×907×782mm
Main unit mass			67kg	71kg	148kg	156kg	162kg
Control unit dimensions and mass			114 W ×360 D ×96 H mm LED/Halogen:3.5kg				
Maximum power consumption (with the illumination unit)			LED: 55W Halogen bulb: 90W*2				

* The following suffixes are added to the order No. (e.g.: 176-861-10) to specify the User Manual's language: -10 for English; -11 for Chinese; No suffix for Japanese.
*1: Measured in conformance with JIS B 7153 *2: The value only in a transmitted illumination

Replacement halogen bulb (transmitted)	Standard: **513667** (12V/50W)
	Long life: **12BAB345** (12V/50W)

Replacement halogen bulb (reflected) (separate light source)	For details, see p.30.

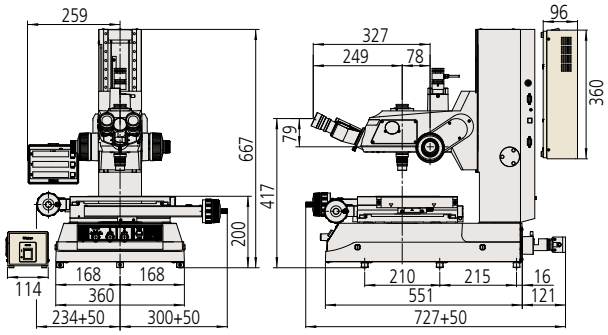
Measuring Microscopes
MF Series
Dimensions

The LED illumination unit is shown on the drawings below.
The control unit is placed to the side of the microscope or directly attached to the rear of the column
The cable for connecting the control unit and microscope main unit is 600mm in length.

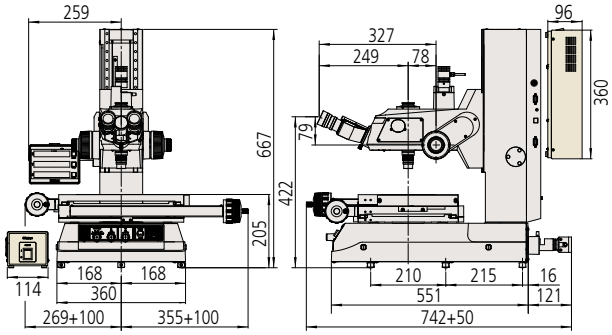
MF D

Unit: mm

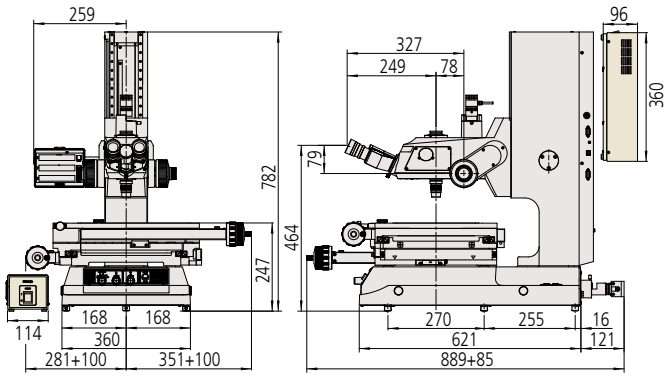
MF-B1010D



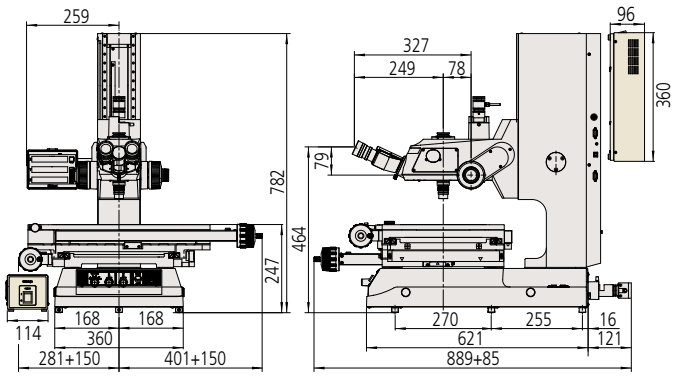
MF-B2010D



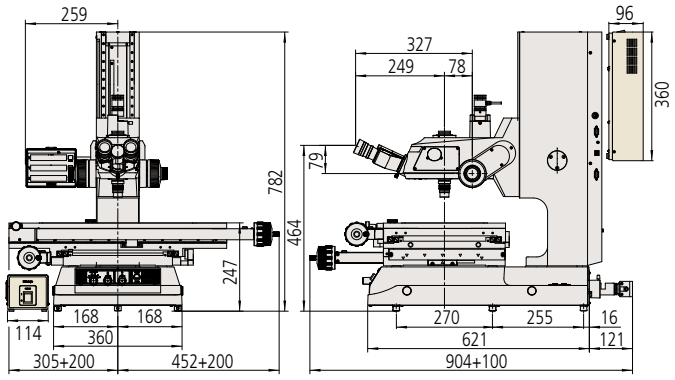
MF-B2017D



MF-B3017D



MF-B4020D



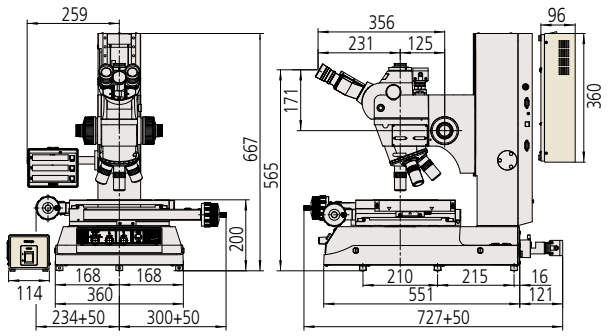
Universal Measuring Microscopes
MF-U Series
Dimensions

The LED illumination unit is shown on the drawings below.
The control unit is placed to the side of the microscope or directly attached to the rear of the column
The cable for connecting the control unit and microscope main unit is 600mm in length.

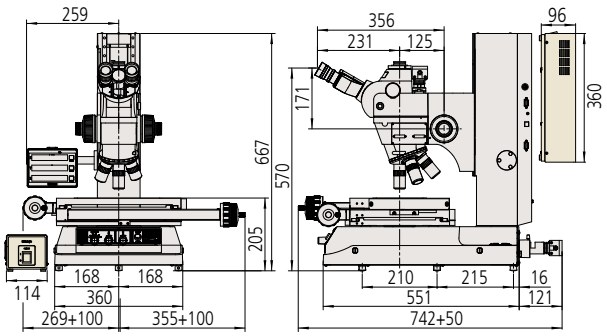
MF-U D

Unit: mm

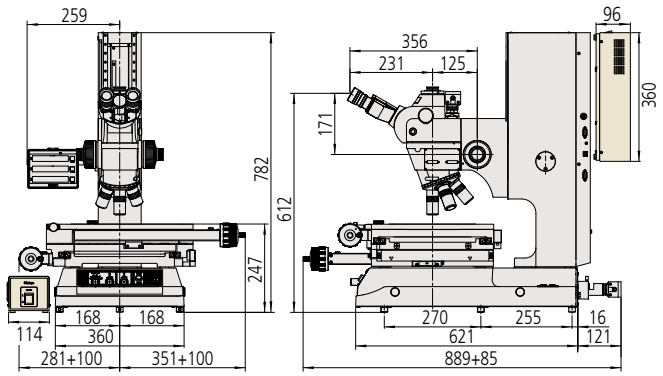
MF-UB1010D



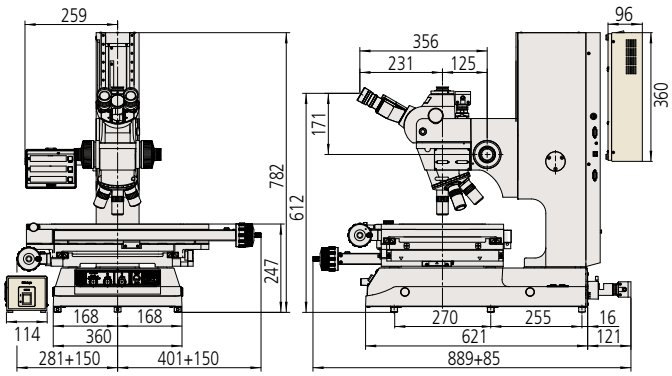
MF-UB2010D



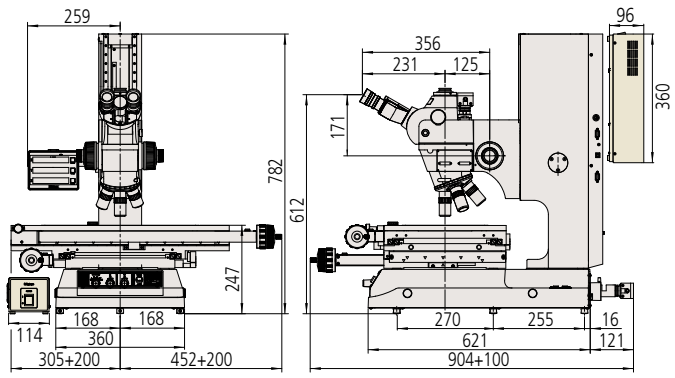
MF-UB2017D



MF-UB3017D

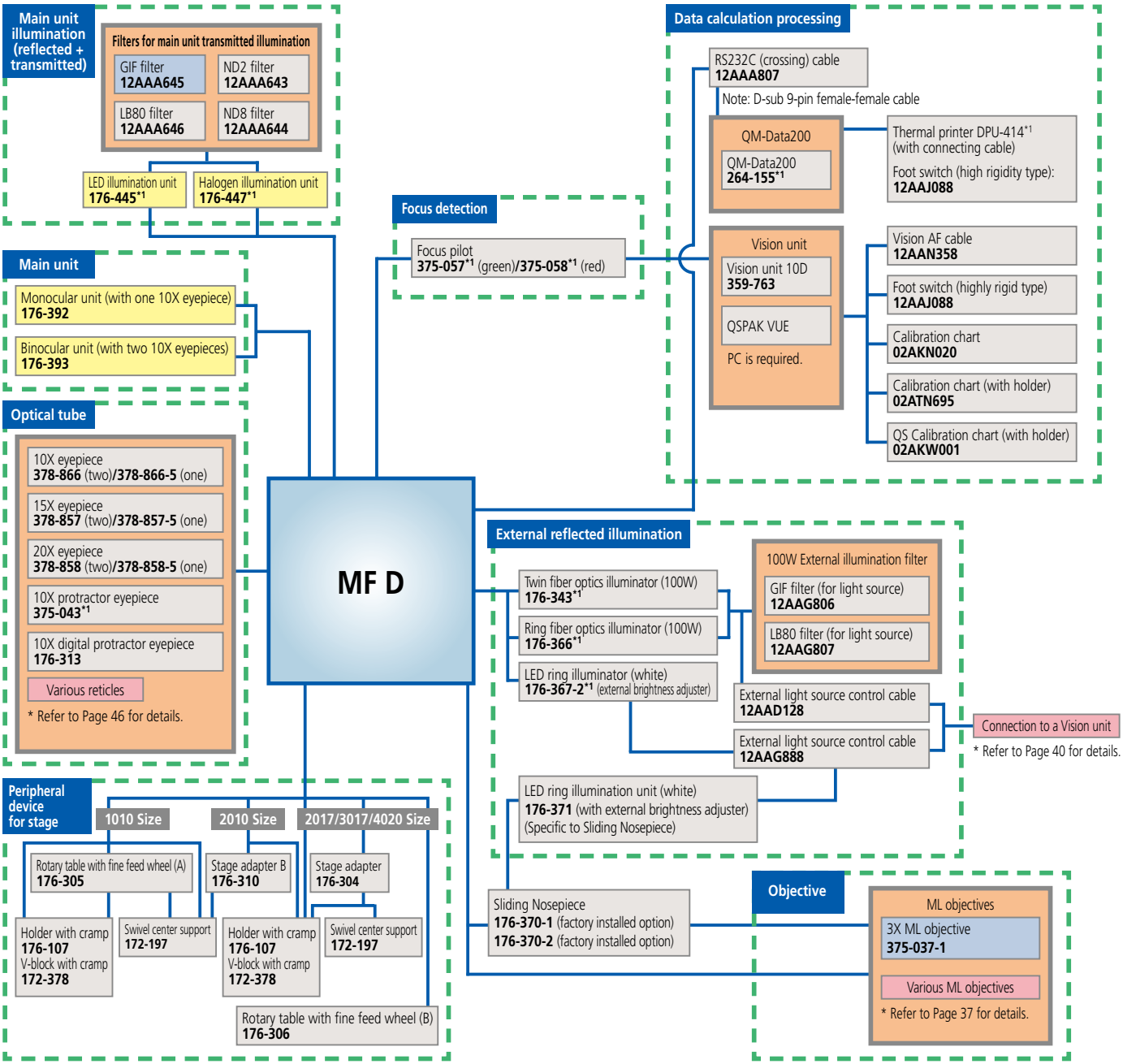


MF-UB4020D



Measuring Microscopes MF Series

Optional Accessories
System Diagrams


Main unit illumination (reflected + transmitted)
Filters for main unit transmitted illumination
GIF filter 12AAA645
ND2 filter 12AAA643
LB80 filter 12AAA646
ND8 filter 12AAA644
LED illumination unit 176-445*1
Halogen illumination unit 176-447*1
Main unit
Monocular unit (with one 10X eyepiece) 176-392
Binocular unit (with two 10X eyepieces) 176-393
Optical tube
10X eyepiece 378-866 (two)/378-866-5 (one)
15X eyepiece 378-857 (two)/378-857-5 (one)
20X eyepiece 378-858 (two)/378-858-5 (one)
10X protractor eyepiece 375-043*1
10X digital protractor eyepiece 176-313
Various reticles
* Refer to Page 46 for details.
MF D
Focus detection
Focus pilot 375-057*1 (green)/375-058*1 (red)
Data calculation processing
RS232C (crossing) cable 12AAA807
Note: D-sub 9-pin female-female cable
QM-Data200
QM-Data200 264-155*1
Thermal printer DPU-414*1 (with connecting cable)
Foot switch (high rigidity type): 12AAJ088
Vision unit
Vision unit 10D 359-763
QSPAK VUE
PC is required.
Vision AF cable 12AAN358
Foot switch (highly rigid type) 12AAJ088
Calibration chart 02AKN020
Calibration chart (with holder) 02ATN695
QS Calibration chart (with holder) 02AKW001
External reflected illumination
Twin fiber optics illuminator (100W) 176-343*1
Ring fiber optics illuminator (100W) 176-366*1
LED ring illuminator (white) 176-367-2*1 (external brightness adjuster)
100W External illumination filter
GIF filter (for light source) 12AAG806
LB80 filter (for light source) 12AAG807
External light source control cable 12AAD128
External light source control cable 12AAG888
Connection to a Vision unit
* Refer to Page 40 for details.
LED ring illumination unit (white) 176-371 (with external brightness adjuster) (Specific to Sliding Nosepiece)
Peripheral device for stage
1010 Size
2010 Size
2017/3017/4020 Size
Rotary table with fine feed wheel (A) 176-305
Stage adapter B 176-310
Stage adapter 176-304
Holder with cramp 176-107
V-block with cramp 172-378
Swivel center support 172-197
Holder with cramp 176-107
V-block with cramp 172-378
Swivel center support 172-197
Rotary table with fine feed wheel (B) 176-306
Sliding Nosepiece
176-370-1 (factory installed option)
176-370-2 (factory installed option)
Objective
ML objectives
3X ML objective 375-037-1
Various ML objectives
* Refer to Page 37 for details.

Printing of counter data

Thermal printer DPU414*1 (with connecting cable)

Foot switch (highly rigid type) **12AAJ088**

Data management

Real-time process control
MeasurLink
Inspection table creation program
MeasureReport

Note: A PC is required.

RS232C (crossing) cable **12AAA807**

Optional peripheral device

Vibration damping stand **176-308**

Mounting stand (microscope + QM-Data 200) **176-309**

Vertical system rack (for Vision Unit) **998923**

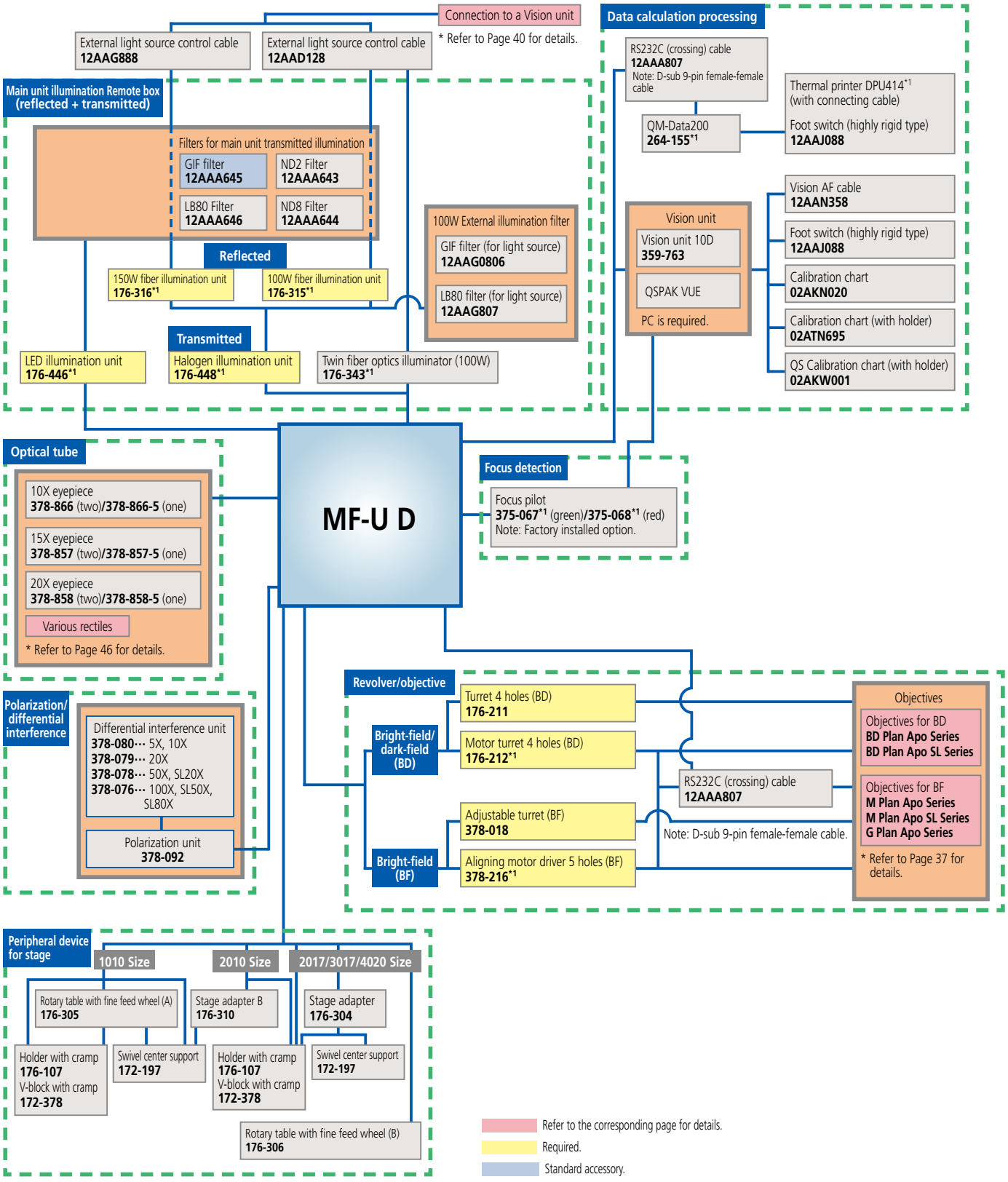
Lens cleaning set **12AAA165**

Stage micrometer **375-056**

*1 Order No. depends on the destination.

Universal Measuring Microscopes MF-U Series

Optional Accessories
System Diagrams


Connection to a Vision unit
* Refer to Page 40 for details.
External light source control cable 12AAG888
External light source control cable 12AAD128
Data calculation processing
RS232C (crossing) cable 12AAA807
Note: D-sub 9-pin female-female cable
Thermal printer DPU414*1 (with connecting cable)
QM-Data200 264-155*1
Foot switch (highly rigid type) 12AAJ088
Main unit illumination Remote box (reflected + transmitted)
Filters for main unit transmitted illumination
GIF filter 12AAA645
ND2 Filter 12AAA643
LB80 Filter 12AAA646
ND8 Filter 12AAA644
Reflected
150W fiber illumination unit 176-316*1
100W fiber illumination unit 176-315*1
100W External illumination filter
GIF filter (for light source) 12AAG0806
LB80 filter (for light source) 12AAG807
Transmitted
LED illumination unit 176-446*1
Halogen illumination unit 176-448*1
Twin fiber optics illuminator (100W) 176-343*1
Vision unit
Vision unit 10D 359-763
QSPAK VUE
PC is required.
Vision AF cable 12AAN358
Foot switch (highly rigid type) 12AAJ088
Calibration chart 02AKN020
Calibration chart (with holder) 02ATN695
QS Calibration chart (with holder) 02AKW001
Optical tube
10X eyepiece 378-866 (two)/378-866-5 (one)
15X eyepiece 378-857 (two)/378-857-5 (one)
20X eyepiece 378-858 (two)/378-858-5 (one)
Various rectiles
* Refer to Page 46 for details.
MF-U D
Focus detection
Focus pilot 375-067*1 (green)/375-068*1 (red)
Note: Factory installed option.
Polarization/ differential interference
Differential interference unit
378-080··· 5X, 10X
378-079··· 20X
378-078··· 50X, SL20X
378-076··· 100X, SL50X, SL80X
Polarization unit 378-092
Revolver/objective
Bright-field/ dark-field (BD)
Turret 4 holes (BD) 176-211
Motor turret 4 holes (BD) 176-212*1
Bright-field (BF)
Adjustable turret (BF) 378-018
Aligning motor driver 5 holes (BF) 378-216*1
RS232C (crossing) cable 12AAA807
Note: D-sub 9-pin female-female cable.
Objectives
Objectives for BD
BD Plan Apo Series
BD Plan Apo SL Series
Objectives for BF
M Plan Apo Series
M Plan Apo SL Series
G Plan Apo Series
* Refer to Page 37 for details.
Peripheral device for stage
1010 Size
2010 Size
2017/3017/4020 Size
Rotary table with fine feed wheel (A) 176-305
Stage adapter B 176-310
Stage adapter 176-304
Holder with cramp 176-107
V-block with cramp 172-378
Swivel center support 172-197
Holder with cramp 176-107
V-block with cramp 172-378
Swivel center support 172-197
Rotary table with fine feed wheel (B) 176-306
Refer to the corresponding page for details.
Required.
Standard accessory.

Mitutoyo

Motor-Driven Z-axis Measuring Microscopes

MF Series/MF-U Series

Stage operation for X and Y axes are not changed, but motorized Z axis on the measuring microscope provides improved operability. High-speed Image Auto Focus (AF) is enabled by using the image detection unit (option).

NEW Products

MF-J2017D

* The binocular tube, eyepieces, and LED illumination unit are optional accessories.
* A separate LED control unit and control unit are included.

MF-UJ2017D

* The turret, objectives, and LED illumination unit are optional accessories.
* A separate LED control unit and control unit are included.

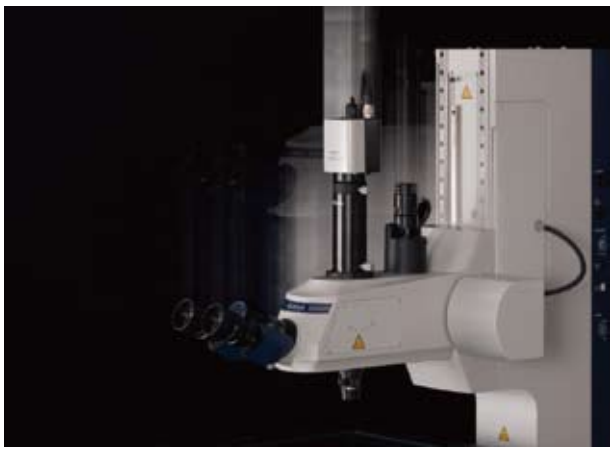
Features

- The measuring microscope's Z-axis is now motor driven to improve operability.
  A jog shuttle is used to operate the Z axis, thus realizing a natural feeling when handling the equipment.
  Furthermore, these microscopes are equipped with a stop that you can use to set the lower limit of the Z-axis movement, which enables you to prevent the objective from colliding with the workpiece.
- The operator is relieved from fatigue resulting from repeated handle-turning.
- A quick-release mechanism is fitted in the X and Y axes for rapid positioning during measurement of large workpieces or multipoint measurement.
- Using with a vision unit (option) makes it possible to perform vision AF (auto focus).*1
- The model lineup includes large stage sizes ranging from 200×170mm to 400×200mm.
- The buttons on the remote control box, which is used to perform operations, have been placed to provide operations that feel natural.
- The remote control box is equipped as standard with a data output button, coarse- and fine-feed switching button (only for Z axis), and speed-adjustment function (only for Z axis).

*1 A separate vision AF cable (No. 12AAN358) is required.

Motor-Driven Z-axis Measuring Microscopes
MF Series/MF-U Series

Motor Driven Z-axis

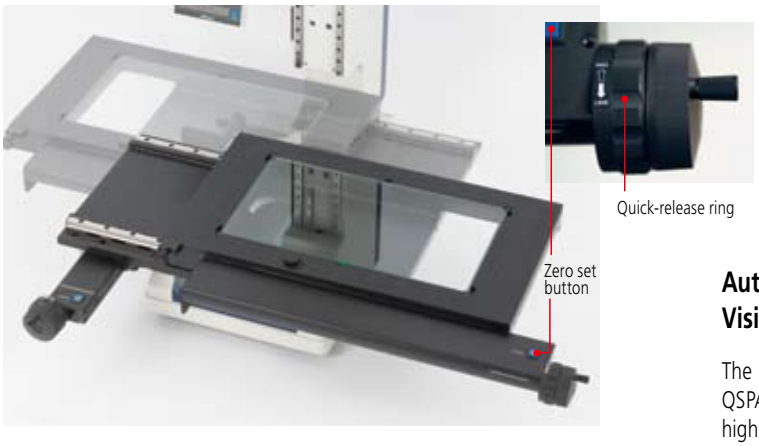


The Z axis is motor driven. Operations during Z-axis measurement can be performed from the Z-axis jog shuttle of the remote control box.
This eliminates the conventional handle-turning and focusing operations, reducing fatigue for the operator.
Furthermore, the change to a motor-driven Z axis enables you to use the new vision AF function with the optional vision unit.*1

*1 A vision AF cable (No. 12AAN358) is required.

Quick Release Mechanism*2 and Zero-set Switch Incorporated*3

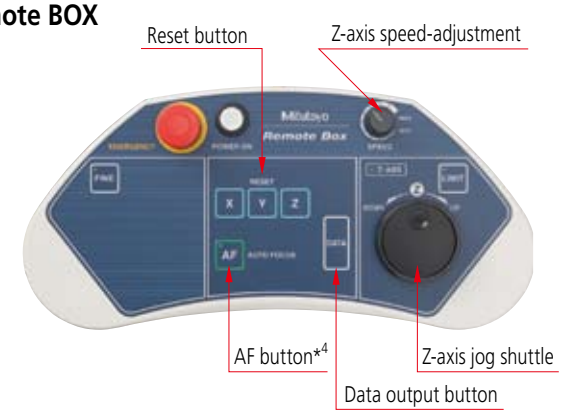
(Common to **MF D** and **MF-U D**)



The stage movement can be switched between extremely coarse and fine (FREE and LOCK) position adjustment by using the quick-release rings adjacent to the X and Y handles. These rings are useful for freeing the stage when the distance to the measurement position is considerable or you want to return quickly to a reference position.
Because this mechanism uses the twist roller method, switching causes little position shift and enables smooth movement. Because the display zero-set switches are located near the handles*3, you can concentrate on the eyepiece during measurement and keep your hands on the handles almost all the time except when adjusting the focus.

*2: Patent registered in Japan
*3: The zero-set buttons are located on the X and Y axes, not the Z axis.

Remote BOX



*4 Usable only if the Vision Unit (option) is fitted.

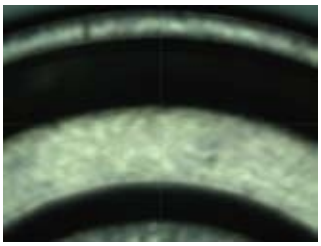
Data Processor Vision Unit

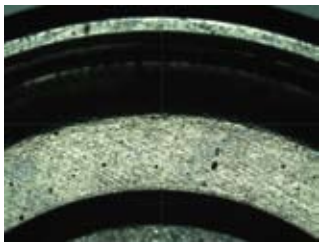
*Combination of the **MF-G2017D** and the the 10D vision unit

Motor-driven Z-axis measuring microscopes can be equipped with the "QMData200" two-dimensional data processing unit and the "Vision Unit" manual image measurement system that detects edges with its installed digital camera.
It is now possible to perform vision AF by using a vision unit, thanks to the new motor drive.

Auto Focus Vision AF (Common Option)

The optional vision unit provides a valuable auto focus function by enabling QSPAK software control of the head position to detect the image with the highest contrast, and hence sharpest focus. This operation can be conducted faster than carrying out focusing with the naked eye and so contributes to a reduction in operation time and operator fatigue.





Motor-Driven Z-axis Measuring Microscopes
MF Series

Specifications for MF D

Model No.		MF-J2017D	MF-J3017D	MF-J4020D
Order No.		176-891*	176-892*	176-893*
Optical tube (eyepiece(s) required)		Monocular or binocular (angle of column: 25°)		
		Standard TV camera port for all models, reticle (broken cross-hair, line width: 5µm), observation/TV camera = 50/50		
Observation image		Erect image		
Observation method		Bright-field observation		
Eyepiece (optional) Adjustable diopter		10X (eyepiece field number: 24), 15X, 20X Note: Monocular - one 10X eyepiece provided as standard; Binocular - two 10X eyepieces provided as standard		
Objective (optional)		ML objective 3X (provided as standard), 1X, 5X, 10X, 20X, 50X, 100X		
Z axis	Max. workpiece height	220mm		
	Feed mechanism	Motordrive (Maximum measuring speed: 20mm/s)		
Illumination unit (required)	LED	Transmitted: Telecentric, built-in aperture diaphragm, white LED light source, stepless brightness adjustment, equipped with cooling fan Reflected: Kohler illumination with adjustable aperture diaphragm, white LED light source, stepless brightness adjustment Control unit: Power switch (main switch), AC power supply input connector (100 to 240V)		
	Halogen	Transmitted: Telecentric, built-in aperture diaphragm, 12V/50W halogen lamp, stepless brightness adjustment, with cooling fan Reflected: Kohler illumination with adjustable aperture diaphragm, 12V50W halogen lamp, stepless brightness adjustment with cooling fan Control unit: Power switch (main switch), AC power supply input connector (100 to 240V)		
Illumination filter		One GIF filter is provided as standard (and mountable for both transmitted and reflected illumination)		
Stage	Measurement range	200×170mm	300×170mm	400×200mm
	Tabletop size	410×342mm	510×342mm	610×342mm
	Effective stage glass size	270×240mm	370×240mm	440×240mm
	Swiveling angle	±5°		±3°
	Maximum table loading	20kg		15kg
	Quick release mechanism	Fitted to X and Y axes		
	Zero set switch	Fitted to X and Y axes		
Measurement system		High-accuracy digital scale		
Measuring accuracy*1 (X and Y axes, when not loaded)		(2.2 + 0.02L)µm, L: measuring length (mm)		
Digital display	Minimum reading	1/0.5/0.1µm switchable		
	Display axes	X, Y and Z axes		
	Functions	Zero-setting, direction switching		
Remote BOX		Speed adjustment (X,Y and Z axes), coarse/fine adjustment button (X, Y and Z axes) Jog shuttle (Z axis drive), limit setting (Z axis), emergency stop switch, power source preliminary switch AF button (vision auto focus): effective when connecting to vision unit (optional) Reset button (X, Y and X axes counter), data output button		
Main unit dimensions (WxDxH)		632×892×782mm	682×892×782mm	757×907×782mm
Main unit mass		150kg	158kg	164kg
Control unit dimensions		355×364×106.5mm		
Main unit mass		7kg		
Dimensions for control unit for illumination unit (WxDxH)		114×365×96mm		
Mass for control unit for illumination unit		LED: 3.5kg, halogen: 4kg		
Maximum power consumption		230W		

* To denote your AC power cable add the following suffixes to the order No.: A for UL/CSA, D for CEE, DC for CCC, E for BS, K for KC, C and No suffix are required for PSE.
*1: Measured in conformance with JIS B 7153.

Motor-Driven Z-axis Measuring Microscopes
MF-U Series

Specifications for MF-UD

BF (brightfield)		**Model No.**	**MF-UJ2017D**	**MF-UJ3017D**	**MF-UJ4020D**
		Order No.	**176-894***	**176-895***	**176-896***
BD (brightfield/darkfield)		**Model No.**	**MF-UK2017D**	**MF-UK3017D**	**MF-UK4020D**
		Order No.	**176-897***	**176-898***	**176-899***
Optical tube (eyepiece: required)			Tilting trinocular tube (angle of column: 0 to 30°), Siedentoph type (pupil distance adjustment: 51 to 76mm), Built-in 1X tube lens, reticle (broken cross-hair, line width: 5µm), observation TV camera = 50/50		
Observation image			Erect image		
Observation method			BF, DF (only for MF-UH and UF types), simple polarization, differential interference		
Eyepiece (optional) Adjustable diopter			10X (eyepiece field number: 24, two eyepieces provided as standard), 15X, 20X		
Turret (required)	Bright-field (BF)		Adjustable manual turret or adjustable power turret (Select one.)		
	Bright-field/dark-field (BD)		Manual turret or power turret (Select one.)		
Objective (optional)	Bright-field (BF)		**M Plan Apo, M Plan Apo SL, G Plan Apo series**		
	Bright-field/dark-field (BD)		**BD Plan Apo, BD Plan Apo SL series**		
Z axis	Max. workpiece height		220mm		
	Feed mechanism		Motor drive (measuring speed: max. 20mm/s)		
Illumination unit (required)	LED		Transmitted: Telecentric, built-in aperture diaphragm, white LED light source, stepless brightness adjustment, equipped with cooling fan Reflected: Kohler illumination with adjustable aperture diaphragm, white LED light source, stepless brightness adjustment , equipped with cooling fan Control unit: Power switch (main switch), AC power supply input connector (100 to 240V)		
	Halogen		Transmitted: Telecentric, built-in aperture diaphragm, 12V/50W halogen lamp, stepless brightness adjustment, with cooling fan Reflected: BF/BD Kohler illumination with adjustable aperture diaphragm, 12V100W or 12V15W halogen lamp (selectable), external fiber illumination, stepless brightness adjustment Control unit: Power switch (main switch), AC power supply input connector (100 to 240 V)		
Illumination filter			One GIF filter is provided as standard (and mountable for both transmitted and reflected illumination)		
Stage	Measuring range		200×170mm	300×170mm	400×200mm
	Tabletop size		410×342mm	510×342mm	610×342mm
	Effective stage glass size		270×240mm	370×240mm	440×240mm
	Swiveling angle		±5°		±3°
	Maximum table loading		20kg		15kg
	Quick release mechanism		Fitted to X and Y axes		
	Zero set switch		Fitted to X and Y axes		
Measurement system			High-accuracy digital scale		
Measuring accuracy*1 (X and Y axes, when not loaded)			(2.2 + 0.02L)µm, L: measuring length (mm)		
Digital display	Minimum reading		1/0.5/0.1µm switchable		
	Display axes		X, Y and Z		
	Functions		Zero-setting, direction switching		
Remote BOX			Speed adjustment (X,Y and Z axes), coarse/fine adjustment button (X, Y and Z axes) Jog shuttle (Z axis drive), limit setting (Z axis), emergency stop switch, power source preliminary switch AF button (vision auto focus): effective when connecting to vision unit (optional) AF button (vision auto focus) effective when connecting to vision unit (optional), Reset button (X, Y and X axes counter), data output button		
Laser auto focus (LAF)			—	—	—
Main unit dimensions (WxDxH)			632×892×782mm	682×892×782mm	757×907×782mm
Main unit mass			150kg	158kg	164kg
Dimensions for control unit for illumination unit (mm)			355×364×106.5mm		
Main unit mass			7kg		
Dimensions for control unit for illumination unit (WxDxH)			114×365×96mm		
Mass for control unit for illumination unit			LED: 3.5kg, halogen: 3.5kg		
Maximum power consumption			230W		

* To denote your AC power cable add the following suffixes to the order No.: A for UL/CSA, D for CEE, DC for CCC, E for BS, K for KC, C and No suffix are required for PSE.
*1: Measured in conformance with JIS B 7153.

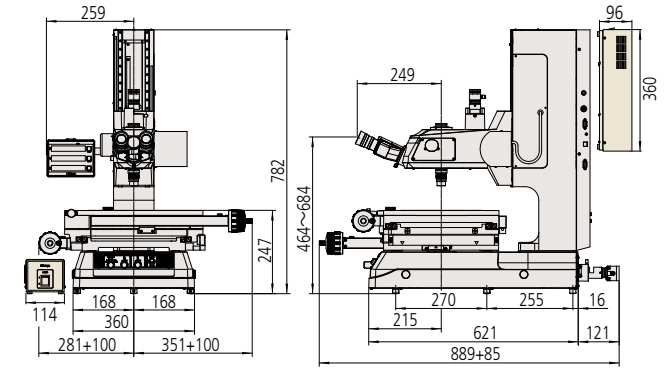
Motor-Driven Z-axis Measuring Microscopes
MF Series/MF-U Series
Dimensions

The LED illumination unit is shown on the drawings below.
The control unit is placed to the side of the microscope or directly attached to the rear of the column
The cable for connecting the control unit and microscope main unit is 600mm in length.

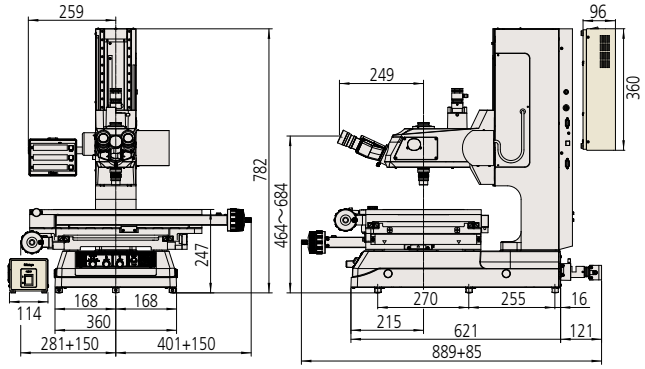
MF D

Unit: mm

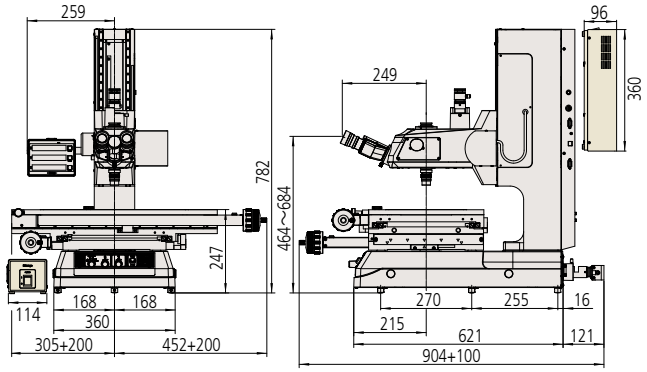
MF-J2017D



MF-J3017D



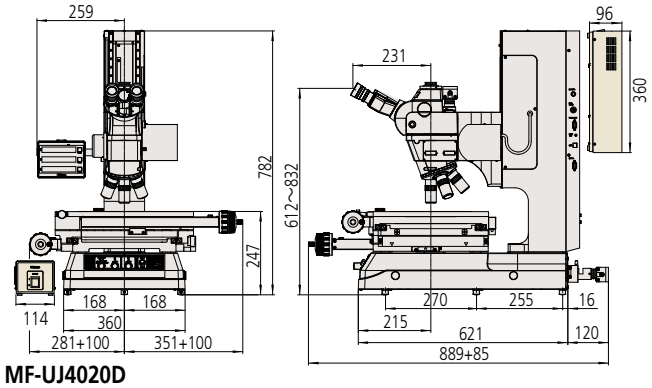
MF-J4020D



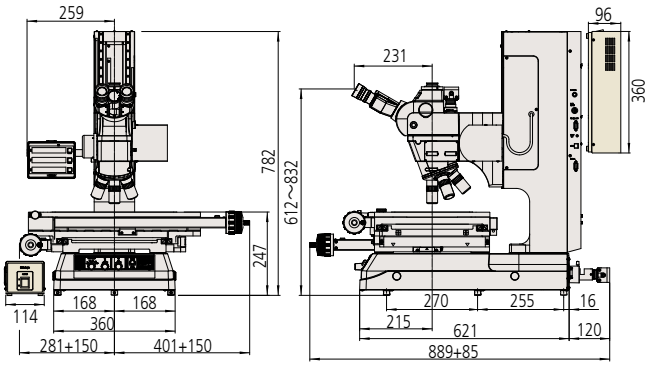
MF-U D

Unit: mm

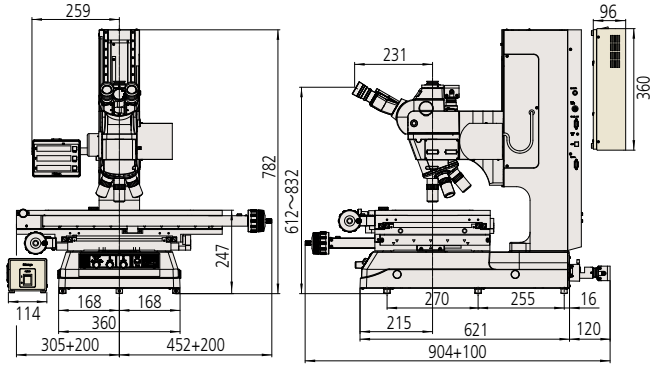
MF-UJ2017D



MF-UJ3017D



MF-UJ4020D

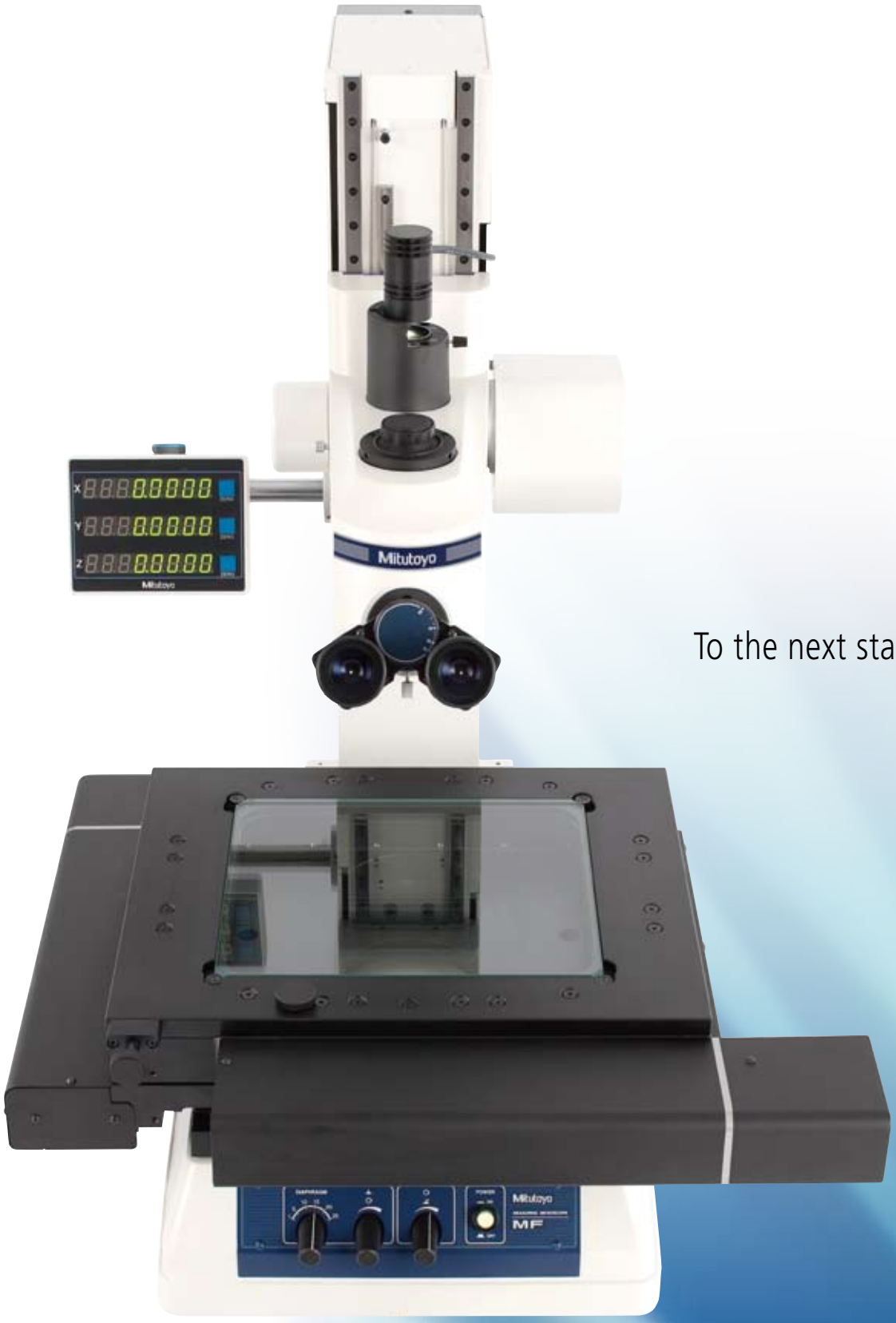


*Motor-Driven Z-axis Measuring Microscope option diagram is shown on pages 34 and 35.

Motor-Driven Measuring Microscopes

MF Series/MF-U Series

Motorized X, Y and Z axes on the measuring microscope provide improved operability.
High-speed Image Auto Focus (AF) is enabled by using the image detection unit (option).



To the next stage

MF-G2017D

* The binocular tube, eyepieces, and LED illumination unit are optional accessories.
* A separate LED control unit and control unit are included.

MF-UG4020D

* The turret, objectives, and LED illumination unit are optional accessories.
* A separate LED control unit and control unit are included.

MF-UE2017D

* The turret, objectives, and LED illumination unit are optional accessories.
* A separate LED control unit and control unit are included.

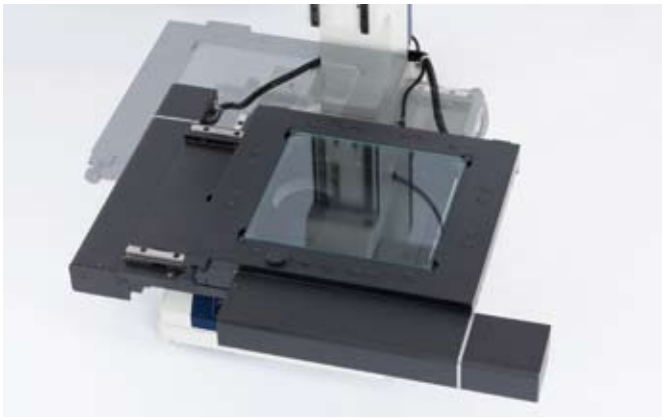
Features

- The measuring microscope's X, Y, and Z axes are now motor driven, and the stage can be operated from a remote control box.
  A joystick is used to operate the X and Y axes, and a jog shuttle is used to operate the Z axis, thus realizing a natural feeling when handling the equipment.
  Furthermore, these microscopes are equipped with a Z limit that you can use to set the lower limit of the Z-axis movement, which enables you to prevent the objective from colliding with the workpiece.
- The operator is relieved from fatigue resulting from repeated handle-turning.
- Installing a vision unit makes it possible to perform vision AF (auto focus).*1
  For the MF-U power type and MF-U power LAF type, selecting the power turret makes it possible for the microscope to automatically recognize the position of the objective in the vision unit.*2
- A power model lineup with large stage sizes ranging from 200×170mm to 400×200mm
- A button for coarse and fine feed switching and speed-adjustment function that are highly useful during long stroke sliding and fine positioning, are provided as standard equipment.
- The buttons on the remote control box, which is used to perform operations, have been placed to provide operations that feel natural.
- The remote control box is standard equipped with a data output button and counter reset buttons for the X, Y, and Z axes, which enables you to perform a variety of operations remotely.
- Products equipped with LAF (laser auto focus) are also included in the lineup of MF-U power products, which improves the efficiency of the focusing operation.
  Models that have LAF are equipped not only with the normal Just Focus (JF) function, but also with the Tracking Focus (TF) function that maintains the focus as the stage moves.
  These functions cater to focusing requirements in a variety of situations, reducing the amount of work that the operator has to perform.

*1 A separate vision AF cable (No. 12AAN358) is required.
*2 RS-232C cable (No. 12AAA807) is required.

Motor-Driven Measuring Microscopes
MF Series/MF-U Series

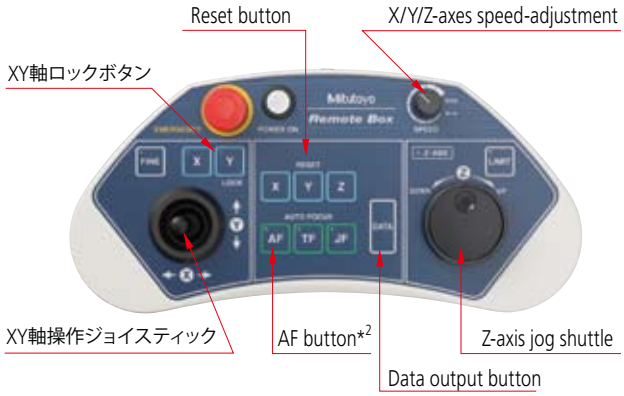
Motor Driven



The X, Y, and Z axes are all motor driven. A joystick is used to operate the X and Y axes, and a jog shuttle is used to operate the Z axis, so operations during measurement can be performed from the remote control box.
This eliminates the conventional handle-turning and focusing operations, reducing fatigue for the operator.
The X and Y axes are driven with a maximum feed speed of 40mm/s and the Z axis with a maximum feed speed of 20mm/s. The lineup includes models that have large stages with sizes ranging from 200×170mm to 400×200mm.
Furthermore, the change to a motor-driven Z axis enables you to use the new vision AF function, provided you also use the optional vision unit.*1

*1: A separate vision AF cable (No. 12AAN358) must be connected.

リモートBOX



*2 Usable only if the Vision Unit (option) is fitted.

Calculation Processor

QM-Data200

* Combination of the MF-G2017D and the QM-Data200

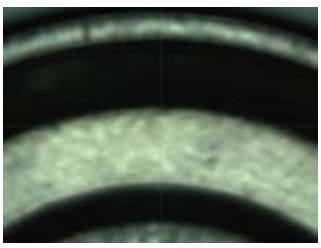
Vision Unit

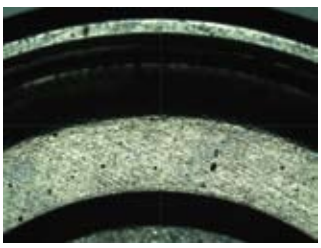
* Combination of the MF-G2017D, the 10D vision unit, and a vision AF cable

Motor-driven measuring microscopes can be equipped with the "QMData200" two-dimensional data processing unit and the "Vision Unit" manual image measurement system that detects edges with its installed digital camera.
It is now possible to perform vision AF by using a vision AF cable together with a vision unit, thanks to the new motor drive.

Auto Focus
Vision AF (Common Option)

By using an optional vision unit and vision AF cable, you can perform vision AF. In the vision unit software QSPAK, the position in the acquired image data with the highest contrast is detected and the auto focus operation performed. This operation can be conducted faster than carrying out focusing with the naked eye, which contributes to reduction in operation time and operator fatigue.





Motor Driven (Option for MF-U Power Product and MF-U Power LAF Product)

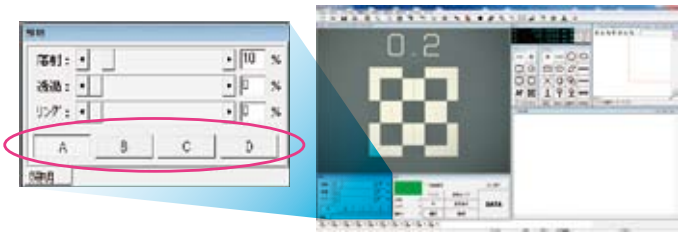
A turret must be selected for the MF-U power product and **MF-U** power LAF product. By selecting the power turret and equipping the measuring microscope with an optional vision unit, it is possible to change and detect the turret position.*1

This is a new function that is available in the QSPAK VUE version 4.1 and subsequent versions of the 10D vision unit software.

You can use the software to change and automatically detect the turret position, so there is no longer any need to handle the turret. Furthermore, this also fixes the problem of forgetting to change calibration values when you change the magnification, thereby providing you with a system that is more reliable and easy to use.

*1: A separate RS-232C cable (**No. 12AAA807**) is required.

Turret Position Display in QSPAK

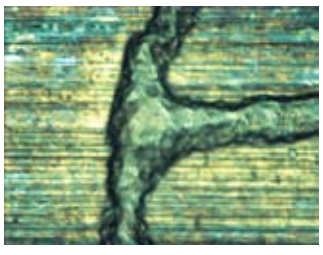


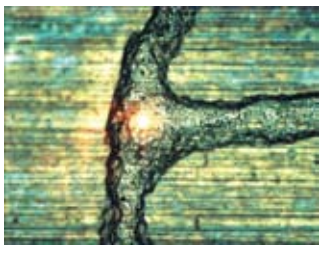
*This image corresponds to 4-hole power turrets and 4-hole turrets with sensors.

Laser Auto Focus (Power LAF Type Only)

LAF (laser auto focus) can be performed by the power LAF product. By employing AF that uses the TTL (Through The Lens) method, in which a semiconductor laser beam with a wavelength of 690nm passes through the lens, these microscopes can perform AF even on minutely-small areas.

Laser auto focus has better repeatability than focusing with the naked eye, and it can be used to measure heights. Furthermore, the following two types of focus functions are equipped as standard: JF (Just Focus), which can be used to target the laser on the point where you want to focus in order to detect the height, and TF (Tracking Focus), which always tracks the focus position.





Motor-Driven Measuring Microscopes
MF Series/MF-U Series

Specifications for MF D

Model No.		MF-G2017D	MF-G3017D	MF-G4020D
Order No.		176-781*	176-782*	176-783*
Optical tube (eyepiece(s) required)		Monocular or binocular (angle of column: 25°)		
		Standard TV camera port for all models, reticle (broken cross-hair, line width: 5µm), observation/TV camera = 50/50		
Observation image		Erect image		
Observation method		Bright-field observation		
Eyepiece (optional) Adjustable diopter		10X (eyepiece field number: 24), 15X, 20X Note: Monocular - one 10X eyepiece provided as standard; Binocular - two 10X eyepieces provided as standard		
Objective (optional)		ML objective 3X (provided as standard), 1X, 5X, 10X, 20X, 50X, 100X		
Z axis	Max. workpiece height	220mm		
	Feed mechanism	Motordrive (Maximum measuring speed: 20mm/s)		
Illumination unit (required)	LED	Transmitted: Telecentric, built-in aperture diaphragm, white LED light source, stepless brightness adjustment, equipped with cooling fan Reflected: Kohler illumination with adjustable aperture diaphragm, white LED light source, stepless brightness adjustment Control unit: Power switch (main switch), AC power supply input connector (100 to 240V)		
	Halogen	Transmitted: Telecentric, built-in aperture diaphragm, 12V/50W halogen lamp, stepless brightness adjustment, with cooling fan Reflected: Kohler illumination with adjustable aperture diaphragm, 12V50W halogen lamp, stepless brightness adjustment with cooling fan Control unit: Power switch (main switch), AC power supply input connector (100 to 240V)		
Illumination filter		One GIF filter is provided as standard (and mountable for both transmitted and reflected illumination)		
Stage	Measurement range	200×170mm	300×170mm	400×200mm
	Tabletop size	410×342mm	510×342mm	610×342mm
	Effective stage glass size	270×240mm	370×240mm	440×240mm
	Swiveling angle	±5°		±3°
	Maximum table loading	20kg		15kg
Measurement system		High-accuracy digital scale		
Measuring accuracy*1 (X and Y axes, when not loaded)		(2.2 + 0.02L)µm, L: measuring length (mm)		
Digital display	Minimum reading	1/0.5/0.1µm switchable		
	Display axes	X, Y and Z axes		
	Functions	Zero-setting, direction switching		
Remote BOX		Joystick (X and Y axes drive), lock button (X and Y axes), speed adjustment (X,Y and Z axes), coarse/fine adjustment button (X, Y and Z axes) Jog shuttle (Z axis drive), limit setting (Z axis), emergency stop switch, power source backup switch AF button (vision auto focus): effective when connecting to vision unit (optional) Reset button (X, Y and X axes counter), data output button		
Main unit dimensions (WxDxH)		632×892×782mm	682×892×782mm	757×907×782mm
Main unit mass		150kg	158kg	164kg
Control unit dimensions		355×364×106.5mm		
Main unit mass		7kg		
Dimensions for control unit for illumination unit (WxDxH)		114×365×96mm		
Mass for control unit for illumination unit		LED: 3.5kg, halogen: 4kg		
Maximum power consumption		230W		

* To denote your AC power cable add the following suffixes to the order No.: A for UL/CSA, D for CEE, DC for CCC, E for BS, K for KC, C and No suffix are required for PSE.
*1: Measured in conformance with JIS B 7153.

Specifications for MF-UD

		Motorized			Motorized LAF		
BF (brightfield)	**Model No.**	**MF-UG2017D**	**MF-UG3017D**	**MF-UG4020D**	**MF-UE2017D**	**MF-UE3017D**	**MF-UE4020D**
	Order No.	**176-784***	**176-785***	**176-786***	**176-790***	**176-791***	**176-792***
BD (brightfield/darkfield)	**Model No.**	**MF-UH2017D**	**MF-UH3017D**	**MF-UH4020D**	**MF-UF2017D**	**MF-UF3017D**	**MF-UF4020D**
	Order No.	**176-787***	**176-788***	**176-789***	**176-793***	**176-794***	**176-795***
Optical tube (eyepiece: required)		Tilting trinocular tube (angle of column: 0 to 30°), Siedentoph type (pupil distance adjustment: 51 to 76mm), Built-in 1X tube lens, reticle (broken cross-hair, line width: 5µm), observation TV camera = 50/50					
Observation image		Erect image					
Observation method		BF, DF (only for MF-UH and UF types), simple polarization, differential interference					
Eyepiece (optional)	Adjustable diopter	10X (eyepiece field number: 24, two eyepieces provided as standard), 15X, 20X					
Turret (required)	Bright-field (BF)	Adjustable manual turret or adjustable power turret (Select one.)			Manual turret with BF sensor, adjustable power turret*1		
	Bright-field/dark-field (BD)	Manual turret or power turret (Select one.)			Manual turret with BD sensor, power turret*1		
Objective (optional)	Bright-field (BF)	**M Plan Apo, M Plan Apo SL, G Plan Apo series**					
	Bright-field/dark-field (BD)	**BD Plan Apo, BD Plan Apo SL series**					
Z axis	Max. workpiece height	220mm					
	Feed mechanism	Motor drive (measuring speed: max. 20mm/s)					
Illumination unit (required)	LED	Transmitted: Telecentric, built-in aperture diaphragm, white LED light source, stepless brightness adjustment, equipped with cooling fan Reflected: Kohler illumination with adjustable aperture diaphragm, white LED light source, stepless brightness adjustment , equipped with cooling fan Control unit: Power switch (main switch), AC power supply input connector (100 to 240V)					
	Halogen	Transmitted: Telecentric, built-in aperture diaphragm, 12V/50W halogen lamp, stepless brightness adjustment, with cooling fan Reflected: BF/BD Kohler illumination with adjustable aperture diaphragm, 12V100W or 12V15W halogen lamp (selectable), external fiber illumination, stepless brightness adjustment Control unit: Power switch (main switch), AC power supply input connector (100 to 240 V)					
Illumination filter		One GIF filter is provided as standard (and mountable for both transmitted and reflected illumination)					
Stage	Measuring range	200×170mm	300×170mm	400×200mm	200×170mm	300×170mm	400×200mm
	Tabletop size	410×342mm	510×342mm	610×342mm	410×342mm	510×342mm	610×342mm
	Effective stage glass size	270×240mm	370×240mm	440×240mm	270×240mm	370×240mm	440×240mm
	Swiveling angle	±5°		±3°	±5°		±3°
	Maximum table loading	20kg		15kg	20kg		15kg
Measurement system		High-accuracy digital scale					
Measuring accuracy*2 (X and Y axes, when not loaded)		(2.2 + 0.02L)µm, L: measuring length (mm)					
Digital display	Minimum reading	1/0.5/0.1µm switchable					
	Display axes	X, Y and Z					
	Functions	Zero-setting, direction switching					
Remote BOX		Joystick (X and Y axes drive), lock button (X and Y axes), speed adjustment (X,Y and Z axes), coarse/fine adjustment button (X, Y and Z axes) Jog shuttle (Z axis drive), limit setting (Z axis), emergency stop switch, power source backup switch AF button (vision auto focus): effective when connecting to vision unit (optional) LAF button (laser auto focus): effective only for LAF models, just focus (JF), tracking focus (TF) Reset button (X, Y and X axes counter), data output button					
Laser auto focus (LAF)		—	—	—	✓	✓	✓
Main unit dimensions (WxDxH)		632×892×782mm	682×892×782mm	757×907×782mm	608×790×846mm	658×790×846mm	733×790×846mm
Main unit mass		150kg	158kg	164kg	155kg	163kg	169kg
Dimensions for control unit for illumination unit (mm)		355×364×106.5mm					
Main unit mass		7kg					
Dimensions for control unit for illumination unit (WxDxH)		114×365×96mm					
Mass for control unit for illumination unit		LED: 3.5kg, halogen: 3.5kg					
Maximum power consumption		230W					

* To denote your AC power cable add the following suffixes to the order No.: A for UL/CSA, D for CEE, DC for CCC, E for BS, K for KC, C and No suffix are required for PSE.
*1: Make sure that you use RS-232C cable (No. 12AAA807) to connect a LAF model and a power turret.
*2: Measured in conformance with JIS B 7153.

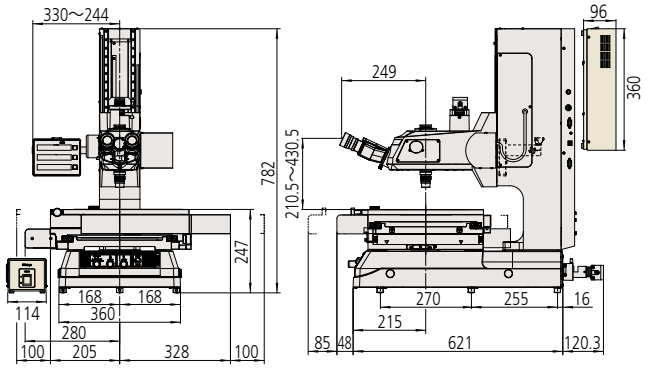
Motor-Driven Measuring Microscopes
MF Series/MF-U Series
Dimensions

The LED illumination unit is shown on the drawings below.
The control unit is placed to the side of the microscope or directly attached to the rear of the column
The cable for connecting the control unit and microscope main unit is 600mm in length.

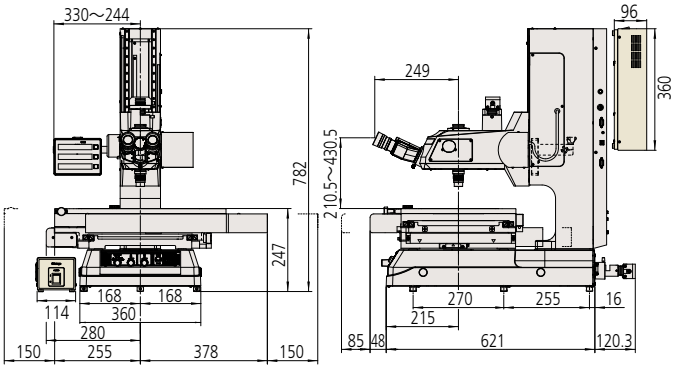
MF D

Unit: mm

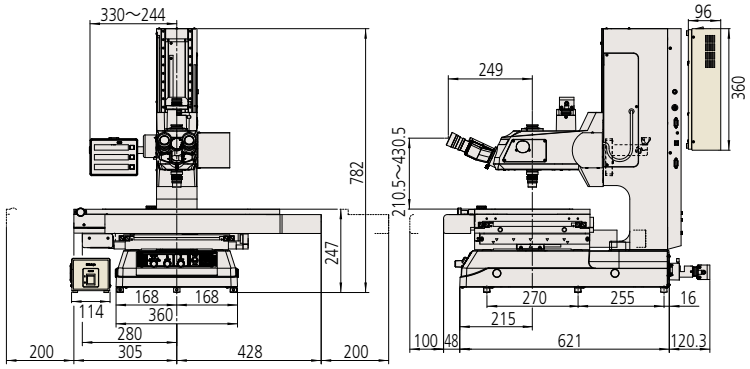
MF-G2017D



MF-G3017D



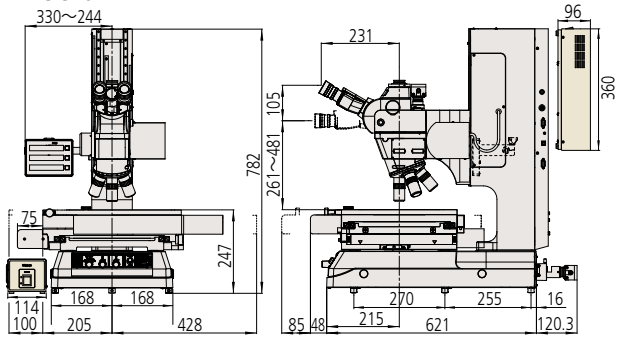
MF-G4020D



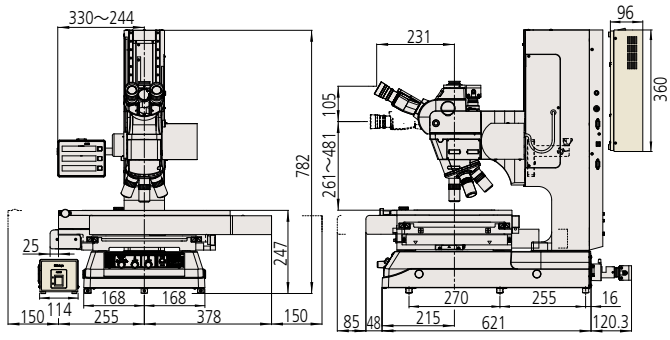
MF-U D (Motorized models)

Unit: mm

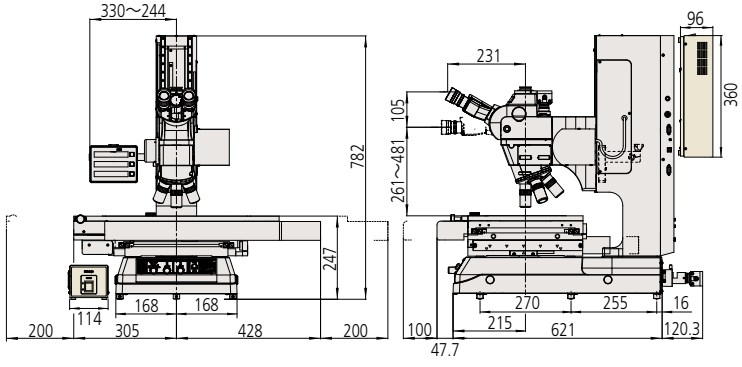
MF-UG2017D



MF-UG3017D



MF-UG4020D

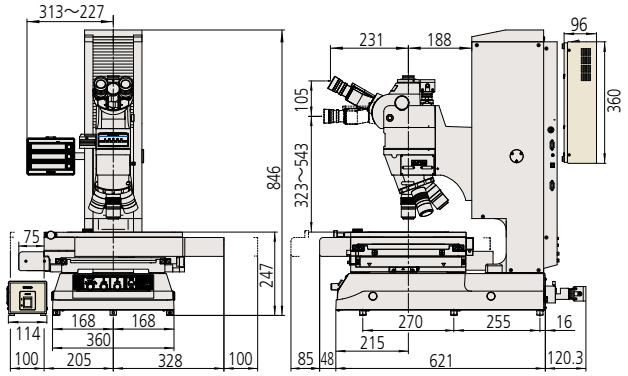


The LED illumination unit is shown on the drawings below.
The control unit is placed to the side of the microscope or directly attached to the rear of the column
The cable for connecting the control unit and microscope main unit is 600mm in length.

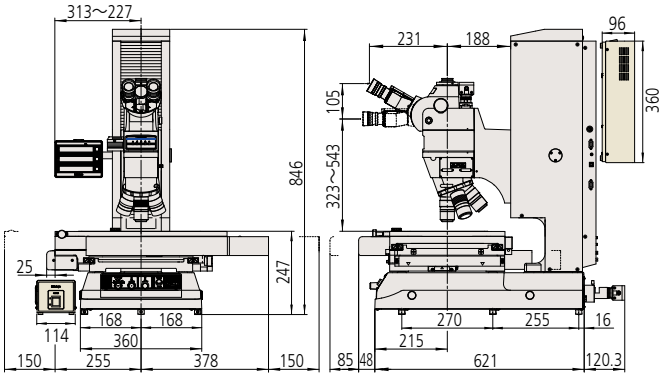
MF-U D (Motorized LAF models)

Unit: mm

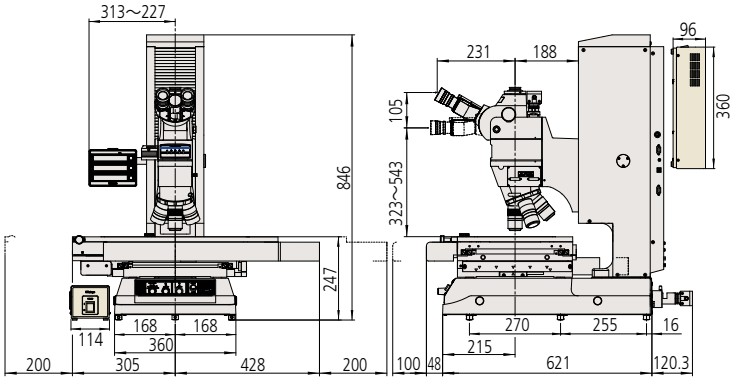
MF-UF2017D



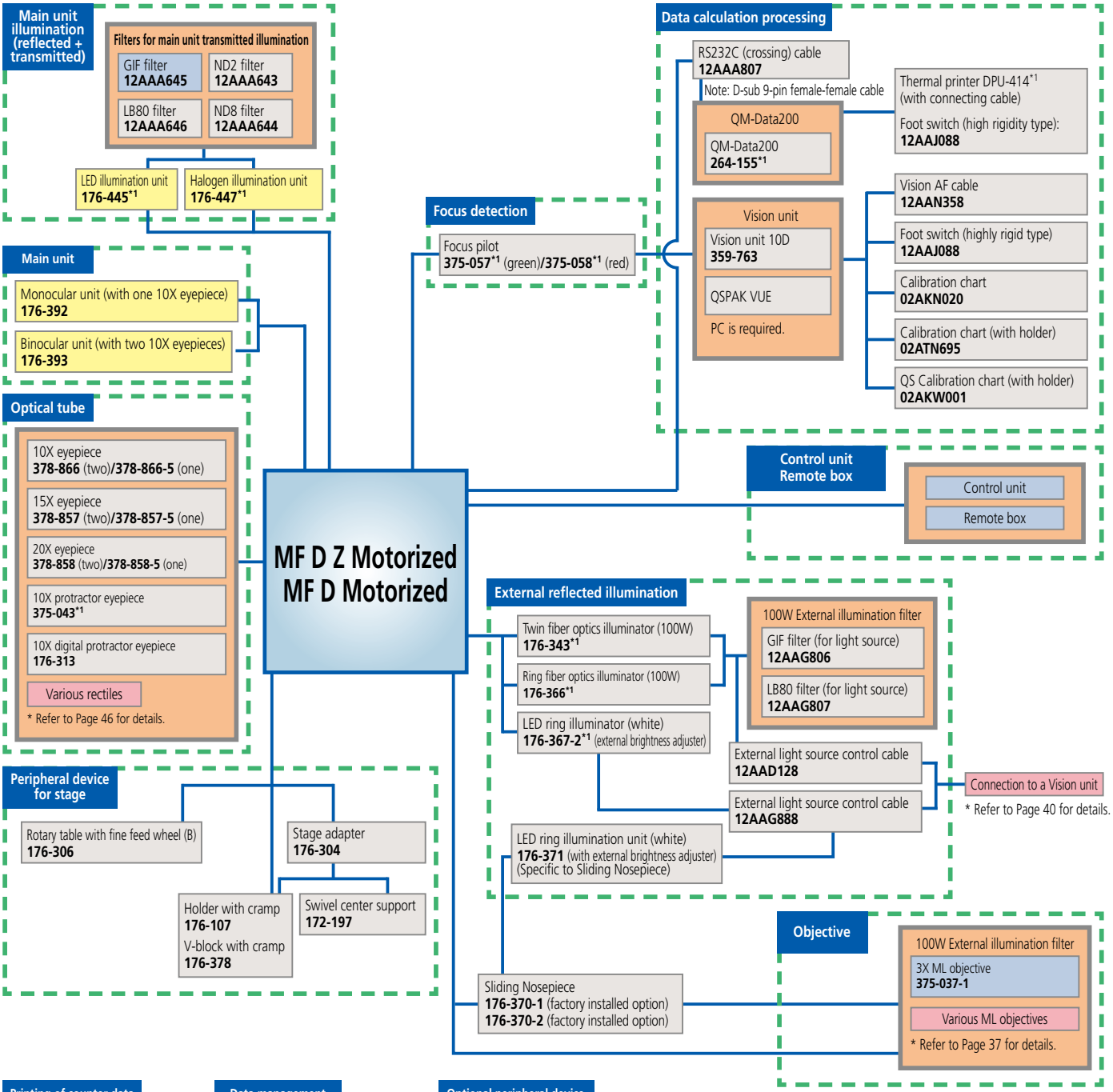
MF-UF3017D



MF-UF4020D



Motor-Driven Z-axis/Motor-Driven
Measuring Microscopes MF Series/MF-U Series
Optional Accessories
System Diagrams


Main unit illumination (reflected + transmitted)
Filters for main unit transmitted illumination
GIF filter 12AAA645
ND2 filter 12AAA643
LB80 filter 12AAA646
ND8 filter 12AAA644
LED illumination unit 176-445*1
Halogen illumination unit 176-447*1
Main unit
Monocular unit (with one 10X eyepiece) 176-392
Binocular unit (with two 10X eyepieces) 176-393
Optical tube
10X eyepiece 378-866 (two)/378-866-5 (one)
15X eyepiece 378-857 (two)/378-857-5 (one)
20X eyepiece 378-858 (two)/378-858-5 (one)
10X protractor eyepiece 375-043*1
10X digital protractor eyepiece 176-313
Various rectiles
* Refer to Page 46 for details.
Peripheral device for stage
Rotary table with fine feed wheel (B) 176-306
Stage adapter 176-304
Holder with cramp 176-107
V-block with cramp 176-378
Swivel center support 172-197
MF D Z Motorized
MF D Motorized
Focus detection
Focus pilot 375-057*1 (green)/375-058*1 (red)
Data calculation processing
RS232C (crossing) cable 12AAA807
Note: D-sub 9-pin female-female cable
QM-Data200
QM-Data200 264-155*1
Thermal printer DPU-414*1 (with connecting cable)
Foot switch (high rigidity type): 12AAJ088
Vision unit
Vision unit 10D 359-763
QSPAK VUE
PC is required.
Vision AF cable 12AAN358
Foot switch (highly rigid type) 12AAJ088
Calibration chart 02AKN020
Calibration chart (with holder) 02ATN695
QS Calibration chart (with holder) 02AKW001
Control unit Remote box
Control unit
Remote box
External reflected illumination
Twin fiber optics illuminator (100W) 176-343*1
Ring fiber optics illuminator (100W) 176-366*1
LED ring illuminator (white) 176-367-2*1 (external brightness adjuster)
100W External illumination filter
GIF filter (for light source) 12AAG806
LB80 filter (for light source) 12AAG807
External light source control cable 12AAD128
External light source control cable 12AAG888
Connection to a Vision unit
* Refer to Page 40 for details.
LED ring illumination unit (white) 176-371 (with external brightness adjuster) (Specific to Sliding Nosepiece)
Objective
Sliding Nosepiece 176-370-1 (factory installed option) 176-370-2 (factory installed option)
100W External illumination filter
3X ML objective 375-037-1
Various ML objectives
* Refer to Page 37 for details.

Printing of counter data

- Thermal printer DPU414*1 (with connecting cable)
- Foot switch (highly rigid type) **12AAJ088**

Data management

- Real-time process control **MeasurLink**
  Inspection table creation program **MeasureReport**

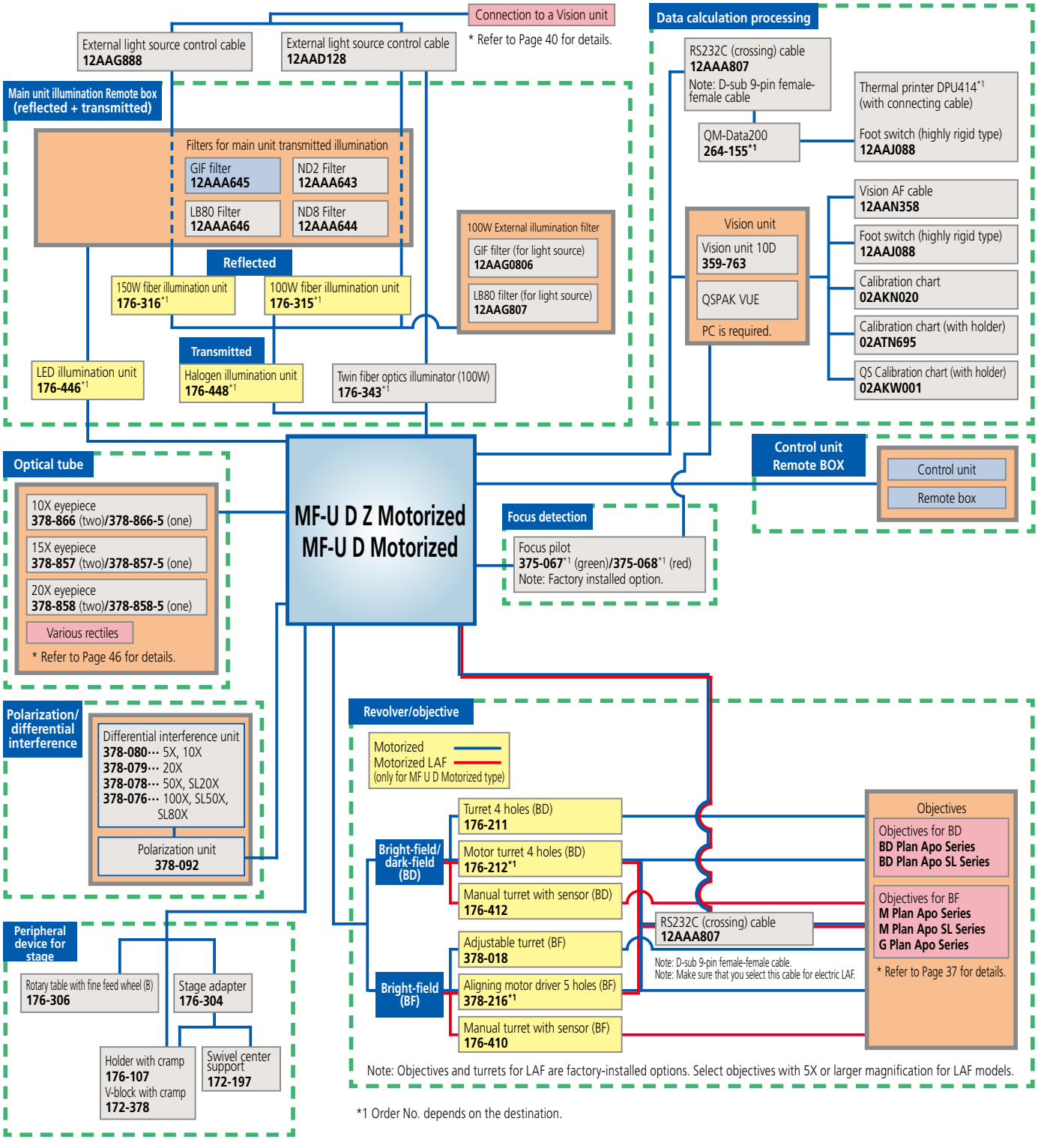
Note: A PC is required.

- RS232C (crossing) cable **12AAA807**

Optional peripheral device

- Vibration damping stand **176-308**
- Mounting stand (microscope + QM-Data 200) **176-309**
- Vertical system rack (for Vision Unit) **998923**
- Lens cleaning set **12AAA165**
- Stage micrometer **375-056**

*1 Order No. depends on the destination.



*1 Order No. depends on the destination.

Refer to the corresponding page for details.
Required.
Standard accessory.

Optional Accessories
Lenses

Our eyepieces provide a wide field of view (with field number 24 when using 10X magnification) to enable easy observation and measurement of objects. The standard objectives provide a bright image with a long working distance and less flare. For both the bright-field and dark-field FS objectives, plan apochromat specifications are used. We think that being able to observe and measure objects without fatigue, even for long periods of time, is very important.

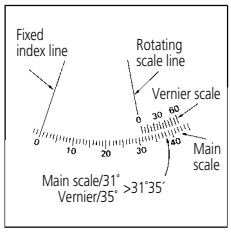
Eyepieces

Eyepieces

	WF10X/24	WF15X/16	WF20X/12
Order No. (1 piece)	**378-866-5**	**378-857-5**	**378-858-5**
Order No. (2 pieces)	**378-866**	**378-857**	**378-858**
Magnification	10X	15X	20X
Field number	24	16	12
Applicable model	**MF D / MF-U D**		

· Only the 10X model includes the eye shade.

· If using a measuring microscope older than the MF B series with a binocular eyepiece, select Order No. **378-866**.



Protractor Eyepiece

Order No.	**375-043**
Magnification	10X
Field number	21
Scale	360° 5′
Applicable model	**MF D**

Digital Protractor Eyepiece

Order No.		**176-313**[*1]
Eyepiece detector unit	Magnification	10X
	Field number	22
	Reticle	Line width: 5µm for both 90° solid lines and 45° chain lines
	Measuring range	Degrees: 0.00° to ± 369.99° Arc-minutes: 0° 00′ to ± 369° 59′
	Detection method	Electrostatic capacitance encoder
	External dimensions (mm)	ø120×140(D)
Digital counter (standard equipment) Supports CE	Minimum reading	0.01° (degree) or 1′ (arc-minute)
	Function	Zero-set ABS*/INC selection, degree or arc-minute selection, data output (with foot switch **12AAJ088**)
	Output	RS-232C
	External dimensions (mm)	143(W)×112(D)×57(H)
	Power supply	AC100~120V
	Applicable model	**MF D** (fixable to the top surface of the counter)

*This measurement system does not always supply power to the internal scale to display absolute values. The system measures coordinates from any fixed origin.
*1 Order No. depends on the destination.

Optical Tubes

Monocular Tube

Order No.	**176-392**
Magnification	10X
Field number	24
Applicable model	Required for **MF D**

Binocular Tube

Order No.	**176-393**
Magnification	10X
Field number	24
Applicable model	Required for **MF D**

Tilting Binocular Tube

Magnification	10X
Field number	24
Angle of column (tilt angle)	0~30°
Applicable model	Included in **MF-U D** as standard

For inspection or observation using a microscope, high resolution and an ultra-long working distance are important factors for objective usability. Also, using the apochromat specifications (for correction of the red, blue, and yellow wavelengths) to correct chromatic aberration over a wide range of wavelengths and the plan specifications to correct distortion in the image surface, and point aberrations, is also important for getting a clear image across the whole field of view. Mitutoyo's high quality FS objectives have these characteristics, which expands the range of applications for a microscope and greatly improves its usability. These objectives are also helpful when installed in a measuring microscope. The M Plan Apo series and BD Plan Apo series are provided for bright-field observation. The SL (super long) specifications are available for when a long working distance is required. The G Plan Apo series is available corrected for observation through glass of thickness 3.5mm (or 2 to 5mm to special order).

ML objectives

Limited-correction optical system ... For **MF D**

Model No.	Order No.	Magnification	Numerical Aperture (NA)	Working Distance (mm)	Resolving Power (μm)	Depth of Focus ± D.F. (μm)
ML 1X	**375-036-2**	1X	0.03	61.0	9.2	306
ML 3X	**375-037-1**	3X	0.09	77.0	3.06	34
ML 5X	**375-034-1**	5X	0.13	61.0	2.12	16.3
ML 10X	**375-039**	10X	0.21	51.0	1.31	6.2
ML 20X	**375-051**	20X	0.42	20.0	0.65	1.6
ML 50X	**375-052**	50X	0.55	13.0	0.5	0.9
ML 100X	**375-053**	100X	0.70	6.0	0.4	0.6

FS objectives

Infinity corrected optical system ... For **MF-U D**

For bright-field (**BF**) observation and measurement

Model No.	Order No.	Magnification	Numerical Aperture (NA)	Working Distance (mm)	Resolving Power (μm)	Depth of Focus ± D.F. (μm)
M Plan Apo 1X	**378-800-3**	1X	0.025	11.0	11.0	440
M Plan Apo 2X	**378-801-6**	2X	0.055	34.0	5.0	91
M Plan Apo 5X	**378-802-6**	5X	0.14	34.0	2.0	14
M Plan Apo 7.5X	**378-807-3**	7.5X	0.21	35.0	1.3	6.2
M Plan Apo 10X	**378-803-3**	10X	0.28	34.0	1.0	3.5
M Plan Apo 20X	**378-804-3**	20X	0.42	20.0	0.7	1.6
M Plan Apo 50X	**378-805-3**	50X	0.55	13.0	0.5	0.9
M Plan Apo 100X	**378-806-3**	100X	0.70	6.0	0.4	0.6
M Plan Apo SL 20X	**378-810-3**	20X	0.28	30.5	1.0	3.5
M Plan Apo SL 50X	**378-811-3**	50X	0.42	20.5	0.7	1.6
M Plan Apo SL 80X	**378-812-3**	80X	0.55	15.0	0.6	1.1
M Plan Apo SL 100X	**378-813-3**	100X	0.70	13.0	0.5	0.9
M Plan Apo SL 200X	**378-816-3**	200X	0.62	13.0	0.4	0.7
M Plan Apo HR 50X	**378-814-4**	50X	0.75	5.2	0.4	0.49
M Plan Apo HR 100X	**378-815-4**	100X	0.90	1.3	0.3	0.34
G Plan Apo 20X (t3.5)	**378-847**	20X	0.28	Air conversion: 29.42	1.0	3.5
G Plan Apo 50X (t3.5)	**378-848-3**	50X	0.50	Air conversion: 13.89	0.6	1.1
Lens set B1	**378-911**	A set including M plan Apo 10X, 20X, 50X, and 100X				
Lens set B2	**378-912**	A set including M plan Apo 2X, 5X and SL20X				
Lens set B3	**378-913**	A set including M plan Apo 5X, 10X, 20X, and 50X				
Replacement adapter for FS objective	**378-026-1**	Used when a bright-field (**BF**) lens is attached to a bright-field and dark-field (**BD**) turret				

For observation and measurement using a bright-field or dark-field (**BD**)

Model No.	Order No.	Magnification	Numerical Aperture (NA)	Working Distance (mm)	Resolving Power (μm)	Depth of Focus ± D.F. (μm)
BD Plan Apo 2X	**378-831-7**	2X	0.055	34.0	5.0	91
BD Plan Apo 5X	**378-832-7**	5X	0.14	34.0	2.0	14
BD Plan Apo 7.5X	**378-830-7**	7.5X	0.21	34.0	1.3	6.2
BD Plan Apo 10X	**378-833-7**	10X	0.28	34.0	1.0	3.5
BD Plan Apo 20X	**378-834-7**	20X	0.42	20.0	0.7	1.6
BD Plan Apo 50X	**378-835-7**	50X	0.55	13.0	0.5	0.9
BD Plan Apo 100X	**378-836-7**	100X	0.70	6.0	0.4	0.6
BD Plan Apo SL 20X	**378-840-7**	20X	0.28	30.5	1.0	3.5
BD Plan Apo SL 50X	**378-841-7**	50X	0.42	20.0	0.7	1.6
BD Plan Apo SL 80X	**378-842-7**	80X	0.50	13.0	0.6	1.1
BD Plan Apo SL 100X	**378-843-7**	100X	0.55	13.0	0.5	0.9
BD Plan Apo HR 50X	**378-845-7**	50X	0.75	5.2	0.4	0.49
BD Plan Apo HR 100X	**378-846-7**	100X	0.90	1.3	0.3	0.34
Lens set D1	**378-931**	A set including BD plan Apo 10X, 20X, 50X, and 100X				
Lens set D2	**378-932**	A set including BD plan Apo 2X, 5X, and SL20X				
Lens set D3	**378-933**	A set including BD plan Apo 5X, 10X, 20X, and 50X				

* Refer to Catalog No. E4191 "MICROSCOPE UNITS AND OBJECTIVES" for details.

Optional Accessories
Illumination

How illumination (a light source) is used is important for observing and measuring various inspected objects such as semiconductors, electronic or electric components, automobile precision components, resin moldings, tools, medical products, and printed materials with clarity and high contrast. Select the best illumination according to the shape, surface conditions, color, and materials in the inspected object.

A: Reflected illumination and transmitted illumination (required)

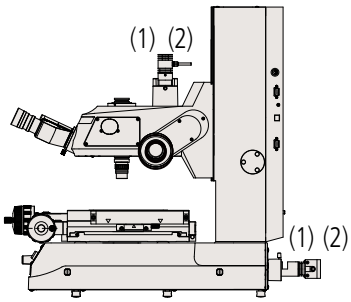
(1)

LED Illumination Unit	
Order No.	**176-445**
	Made up of lamp housing (for reflected illumination and transmitted illumination) and an LED control unit. The LED control unit can be fixed to the rear of the column of the microscope main unit. White light LED (low power consumption: 45W) Rated life of approximately 30,000 hours continuously variable brightness control Built-in cooling fan (includes an alarm for indicating that the fan has stopped) A color filter can be attached to a reflected or transmitted illumination unit.
External dimensions (mm)	Reflected illumination unit: ø33×86 (maximum protrusion) Transmitted illumination unit: 68×103 (maximum protrusion) LED control unit: 114(W)×360(D)×96(H)
Applicable model	**MF D**

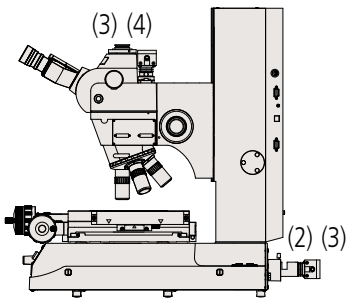
(3)

LED Illumination Unit	
Order No.	**176-446**
	Made up of lamp housing (for reflected illumination and transmitted illumination) and an LED control unit. The LED control unit can be fixed to the rear of the column of microscope main unit. White light LED (low power consumption: 55W) Rated life: Approximately 30,000 hours Continuously variable brightness control Built-in cooling fan (includes an alarm for indicating that the fan has stopped) A color filter can be attached to a reflected or transmitted illumination unit.
External dimensions (mm)	Reflected illumination unit: 68×66 (maximum protrusion) Transmitted illumination unit: 68×103 (maximum protrusion) LED control unit: 114(W)×360(D)×96(H)
Applicable model	**MF-U D**

MF D series



MF-U D series



(2)

Halogen Illumination Unit	
Order No.	**176-447 (MF D)/176-448 (MF-U D)**
	Made up of lamp housing (for reflected illumination and transmitted illumination) and a halogen control unit. The halogen control unit can be fixed to the rear of the column of the microscope main unit. 12V, 50W halogen lamp, continuously variable brightness control Built-in cooling fan (includes an alarm for indicating that the fan has stopped) A color filter can be attached.
External dimensions (mm)	Reflected and transmitted illumination unit: 91×106 (maximum protrusion) Halogen control unit: 114(W)×360(D)×96(H)
適用機種	**MF D/MF-U D**

Note: **MF-U D** is available only for transmitted illumination.

(4)

100W and 150W Fiber Optics Cable Illumination Unit (External Light Source)	
Order No.	**176-315 (100W) ·176-316 (150W)**
100W	12V, 100W halogen lamp (No. **517181**) Rated life: 1,000 hours
	12V, 100W high brightness halogen lamp (No. **12BAD602**) Rated life: 50 hours
	Continuously variable brightness control
External dimensions (mm)	76(W)×235(D)×120(H), Fiberglass cable length: 1,500
150W	15V, 150W halogen lamp (No. **12BAJ076**) Rated life: 500 hours
	15V, 150W high brightness halogen lamp (No. **12BAJ075**) Rated life: 50 hours
	Continuously variable brightness control
External dimensions (mm)	120(W)×273(D)×119(H), Fiberglass cable length: 1,500
Applicable model	For reflected illumination when selecting the halogen illumination unit with **MF-U D**

B **Dual swan-neck light pipe (External Light Source)**

Order No.	**176-343**
	Fixed to the rear of the microscope column. Continuously variable brightness control Includes a condenser lens Auto-brightness control can be used for the Vision Unit system (with external light source control cable No. **12AAD128**). 12V, 100W halogen lamp (No. **517181**), rated life: 1,000 hours 12V, 100W high brightness halogen lamp (No. **12BAD602**), rated life: 50 hours LB80 filter (No. **12AAG807**)
External dimensions (mm)	76(W)×235(D)×120(H): includes only the light source
	Fiber optics cable length: 700 (from the rear fixed portion to the front edge)
	Maximum fiber bending radius: 60
Applicable model	**MF D / MF-U D**

C **Fiber-Optic Ring Light (External Light Source)**

Order No.	**176-366**
	Continuously variable brightness control Includes a condenser lens Auto-brightness control can be used for the Vision Unit system (with external light source control cable No. **12AAD128**). 12V, 100W halogen lamp (No. **517181**) Rated life: 1,000 hours 12V, 100W high brightness halogen lamp (No. **12BAD602**) Rated life: 50 hours LB80 filter (No. **12AAG807**)
External dimensions (mm)	76(W)×235(D)×120(H): includes only the light source
	Circular illumination unit: outside diameter: 60, inside diameter: 35
	Maximum fiber length: 1,000
Applicable model	**MF D** (ML objective 10X or lower model)

A: Reflected and Transmitted Illumination

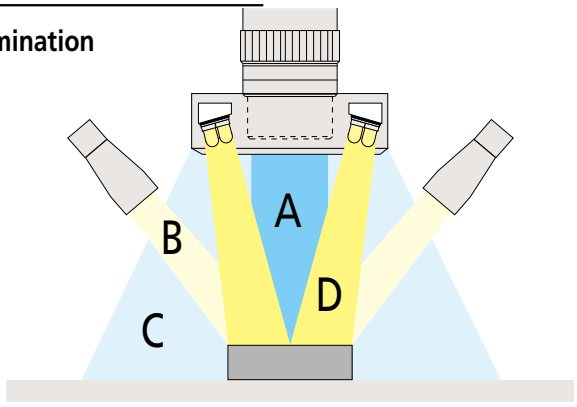
The light is projected vertically downward onto the surface of an inspected object through an objective. An LED or halogen lamp is selectable as the light source.

Image

B: Dual swan-neck light pipe

Light piped from a standalone halogen lamp unit and projected from two heads is suitable for three-dimensional observation. The condenser lens included as standard makes high brightness spot lighting possible.

Image



The four images show the same portion of an inspected object.

C: Fiber-Optic Ring Light

Image

Light piped from a standalone halogen lamp unit and projected from around the objective enables observation that is less affected by shadows due to surface irregularities and is suitable for image measurement.

D: LED Ring Light

Image

Light from an LED array surrounding the objective enables high contrast observation of deeply colored resins, circuit boards, and small cylindrical objects and is also suitable for image measurement. In addition, adjusting the brightness does not change the coloring.

D **LED Ring Light**

Order No.	**176-367-2**
	Continuously variable brightness control Auto-brightness control can be used for the Vision Unit system (with external light source control cable No. **12AAG888**).
External dimensions (mm)	75(W)×150(D)×90(H): only the control part
	Ring LED part: outside diameter: 70, height: 68 to 93
	LED cable length: 1,500
Applicable model	**MF D** (ML objective 10X or lower model)

D **LED Ring Light (for FS Objectives)**

Order No.	**176-367-2*/176-371 (Specific to Sliding Nosepiece)**
	Fixed to an objective and projects ring-shaped white LED light Continuously variable brightness control Auto-brightness control can be used for the Vision Unit system (with external light source control cable No. **12AAG888**).
External dimensions (mm)	75(W)×150(D)×90(H): only the control part
	Ring LED part: outside diameter: 70, height: 65 to 80
	LED cable length: 1,500
Applicable model	**MF-D** (FS objective M plan Pro 10X or lower model)

Mitutoyo

Optional Accessories

Manual Image Measurement Vision Unit

The Vision Unit turns your measuring microscope into a high-performance vision measuring system capable of significantly increasing productivity in quality assurance operations. Vision measurement simply involves generating enough points from the edges of workpiece features to ensure accuracy and then letting powerful PC-based software calculate the measurement results. An image measuring model that aligns edges during image measurement and a dedicated electronic model that can be used for general purposes are available. Both models can print out the measurement results or output them to spreadsheet software or inspection tables.

Typical system

For details, see Catalog No. E14008

Features

- Auto edge detection tool and various macro icons make measurement straightforward
- Easy-to-use graphics and measurement navigation
- Enables measurement results to be output to MS-Excel*1 and an inspection table created on the same PC
- Enables tolerance zone analysis for measurement and calculation results, and various types of statistical processing for each item
- Auto-brightness control that precisely duplicates an illumination setting (when using the measuring microscopes MF-D and MF-UD together)
- Enables measurement within one screen
- Images can be input or saved (in BMP or JPEG format).
- Motor-Driven Z-axis Measuring Microscopes MF Series/MF-U Series (refer to page 22) Image AF is possible when using the motorized measuring microscope MF series/MF-U series (refer to page 28).

Foot switch **No.12AAJ088**

*1. MS-Excel is a Microsoft product.

Specifications

Vision Unit 10D	
Order No.	**359-763**
Magnification of optical system	0.5X: when a microscope is attached (0.5X: when using a TV adapter)
Image detection	High sensitivity 1/2-inch CMOS color camera with 300 million pixels
Resolution	0.1μm
Measuring accuracy for each axis (in a 20°C environment)	Depends on measuring microscope
Accuracy (in a 20°C environment)	Depends on measuring microscope Reference: when using a 3X ML objective (performing an inspection using our standard sample) Screen-internal measuring accuracy: ±2.5μm or less Screen-internal repeatability (2σ): ±1μm or less
PC system*	Windows 7
Software*	QSPAK Vision Unit
Applicable model	**MF D / MF-U D**

* Software (QSPAK) and calculation processor are required separately.

For details, see Catalog No. E14008

CAD Import & Export (Optional software)

Operability has been greatly improved, and the time required to create a part program has been greatly reduced, by importing the CAD data (DXF, IGES), as generated at the product-design stage, to QSPAK. The measurement result from QSPAK can be converted to CAD data.

FEATURES

- The nominal value of each measuring item is entered automatically.
- Graphics data can be output in a specified CAD data format.

FORMTRACEPAK-AP (Optional software)

FORMTEACEPAK-AP allows contour analysis and contour tolerancing against the nominal value, from the data acquired using QSPAK.

FEATURES

- Contour tolerancing function
- Fine contour analysis function
- Report generation function

Contour tolerancing

Optional Accessories

2-D Data Processing Unit QM-Data 200

Typical system

Foot switch No. **12AAJ088**

Features

- Displays high contrast color graphics on a large, backlit, LCD screen
- Enables frequently-performed complex measurement (such as measuring the distance between two circles) to be performed by pressing just one button
- Teaching function for measuring procedure
  Efficient measurement by performing measuring point navigation in the repeat mode
- Eliminates the need to switch measuring command keys through AI-based measurement (which automatically determines the measured element)
- Includes a user menu in which you can individually register measuring commands or part programs
- Enables tolerance zone measurement for measurement and calculation results, and various types of statistical processing for each item
- Enables measurement results to be output to the MS-Excel*1 PC spreadsheet software in CSV format
- Enables part programs and measurement results to be stored in USB memory*2
- A stand that can be tilted to adjust the angle to an easily viewable position
- Enables measurement during printing

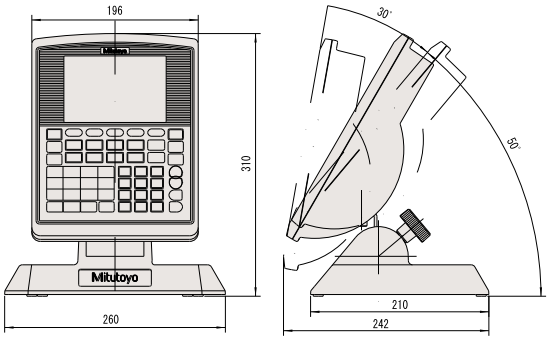
*1. MS-Excel is a Microsoft product.
*2. Not all commercially available USB memory is supported.

Specifications

QM-DATA 200 (Stand Type)	
Order No.	**264-155***
Displayed language	Switched among 16 languages (Japanese, English, French, German, Italian, Spanish, Portuguese, Czech, Chinese (traditional), Chinese (simplified), Korean, Turkish, Swedish, Polish, Dutch and Hungarian
Unit of measurement	Length: mm, angle: degree/degree-minute-second (switchable)
Resolution	0.1µm
Program function	Creating, performing, and editing measuring procedures
Statistical processing	The measured item, number of data items, maximum value, minimum value, average value, standard deviation, range, histogram, and statistics for each measuring function (statistics for each command)
Display field	Color TFT LCD (with a backlight)
Tilt feature	Available
I/O connector	XYZ: for linear scale input ... up to 3 axes RS-232C ①: for connecting a PC (measuring result) RS-232C ②: for connecting the counter of the measuring machine main unit FS: for connecting a foot switch PRINTER: for connecting a receipt or external printer (measuring result) USB-FDD: for connecting a USB-FDD (measuring result file, measuring procedure file) USB-MEMORY: for connecting USB memory (measuring result file, measuring procedure file)
File output of measuring result	RS-232C output (CSV format, MUX-10 format)
Power supply	100V to 240V AC
Maximum power consumption	17W (without including options)
External dimensions (mm)	Approximately 260×242×310mm (including a stand)
Weight	Approximately 2.9kg
Applicable model	**MF D / MF-U D**

* Order No. depends on the destination.

External dimensions (unit: mm)



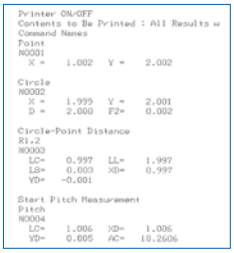
Thermal printer

DPU-414 Manufactured by SII

Specifications

Thermal Printer DPU-414		
Order No.	Connected to QM-Data 200	Please contact with your local Mitutoyo sales office.
	Counter display printing	Please contact with your local Mitutoyo sales office. Note: Combined use with footswitch No. **12AAJ088**
Printing method		Dot-matrix thermosensitive
Number of printing digits		40 digits (9 normal characters (7 dot matrix)
Printing speed		Maximum 52.5 normal characters/s
External dimensions		160mm(W)×170mm(D)×65.5mm(H) (printer)
Standard accessories		Printer cable, printing paper (1 roll), AC adapter (for 100V)
Spare goods	Printing paper (5 rolls)	**No. 908353** (5 rolls)

Printout example



Optional Accessories

We offer various optional accessories designed to increase microscope usability. These optional accessories, which have all been well received by customers, include the focus pilot, which can reduce focal point variation; a power turret and power focusing unit, which can be used to change the focus or magnification by under precise power control and a rotary table, which has a fine-adjustment knob for comfortably rotating objects under inspection. You can also select the polarization and differential interference contrast unit to support microscopic observation, the TV port adapter to attach a camera, which is required by many people during simultaneous analysis and evaluation, and other optional accessories as required.

Focus Detection Unit Focus Pilot

Model type	FP-05	FP-05U
Order No.	**375-057*** (Green) / **375-058*** (Red)	**375-067*** (Green) / **375-068*** (Red)
Light Source	Green LED or Red LED •Concentric circle pattern •Slit pattern • The focal point is the position where the top and bottom of the pattern are aligned. • The brightness can be adjusted according to the reflectivity of the surface. • Observation with a wide field of view on a TV monitor using 5X optical magnification is available.	
Focusing reproducibility	Approximately 1.5µm (when using a 20X lens) ... This is a reference value based on an inspection performed using our standard sample.	
Optical magnification	0.5X	
Magnification accuracy	± 0.1% (within 2/3 of the center of the field of view)	
Camera	Supports up to 2/3 inch	
TV adapter	Equipped with C-mount, centering or parfocal adjusting mechanism	
Power supply	100 to 240V AC, Maximum power approximately 10W	
External dimensions (mm)	Main unit: 131(H) Console box: 90(W)×78(H)×178(D)	
Applicable model	**MF D**	**MF-U D**

Note: The combination of MF-U and FP-05U is a factory-installed option.
* Order No. depends on the destination.

Turrets

Order No.	176-211	176-412	378-018	176-410	176-212*	378-016*	378-216*
Supported observation	For bright-field and dark-field (BD)	For bright-field and dark-field with sensor (BD)	For bright-field (BF)	For bright-field with sensor (BF)	For bright-field and dark-field (BD)	For bright-field (BF)	For bright-field (BF)
Number of ways	4	4	4	4	4	4	5
Centering and parfocal mechanism	—		Standard fixed: 1 position Centering and parfocal: 3 positions		—	Standard fixed: 1 position Centering and parfocal: 3 positions	Standard fixed: 1 position Centering and parfocal: 4 positions
Driving method	Manual				Electric		
Power supply	—				100 to 240V AC		
External dimensions (mm)	—	ø120 × 48.2(H)	ø110 × 50.7(H)	ø120 × 50.6(H)	Turret: 164(W)×65(H)×137(D) Console box: 108(W)×72(H)×193(D) Cable length: 3m		
Applicable model	Required for **MF-U D**						

Sliding Nosepieces (Factory-installed Option)

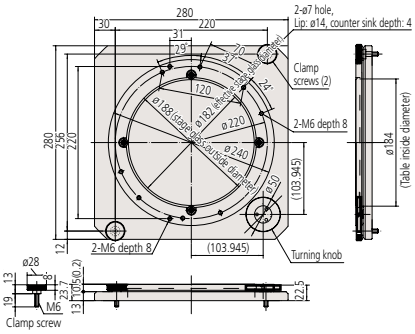
Order No.	**176-370-1** The lens mounted at the centering mechanism (standard) position and the lens mounted at the focal point adjusting mechanism position are parfocal. Note: The magnification of the lens mounted at the focal point adjusting mechanism position is not guaranteed.
Order No.	**176-370-2** Magnification of the lens mounted at the centering mechanism (standard) position and that of the lens mounted at the focal point adjusting mechanism position are guaranteed. Note: The two lenses are not parfocal.
Applicable model	**MF D**

Note: When using an LED ring-illumination unit, a unit specific to the Sliding Nosepiece is required.

Optional Accessories

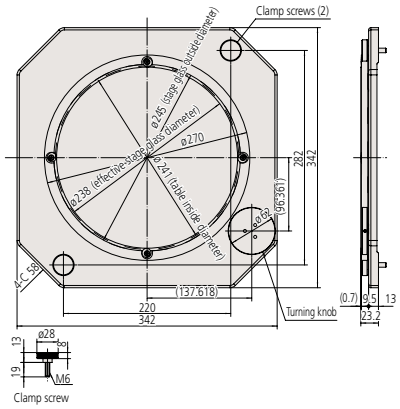
Rotary Table with Fine Feed Wheel (A)	
Order No.	**176-305**
External dimensions	280(W)×280(D)×23.7(H)mm Tabletop: ø240mm, 360° rotation, no angle scale
Mass	5.5kg
Effective glass diameter	182mm
Applicable model	Size 1010, 2010 (**MF D / MF-U D**)

Note: The V-block with Clamp, Swivel Center Support and Holder with Clamp can be mounted on the table.



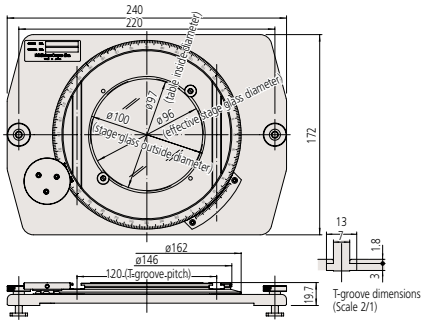
Rotary Table with Fine Feed Wheel (B)	
Order No.	**176-306**
External dimensions	342(W)×342(D)×23.2(H)mm Tabletop: ø270mm, 360° rotation, no angle scale
Mass	6.5kg
Effective glass diameter	238mm
Applicable model	Size 2017, 3017, 4020 (**MF D / MF-U D**)

Note: The V-block with Clamp, Swivel Center Support and Holder with Clamp can NOT be mounted on the table.



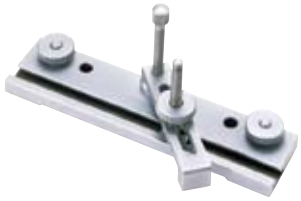
Rotary Table with Fine Feed Wheel (with Scale)	
Order No.	**172-198**
External dimensions	240(W)×172(D)×19.7(H)mm T-groove pitch of the tabletop: 120 Tabletop: ø270mm, 360° rotation, minimum angle adjustment: vernier 2'
Mass	2.4kg
Effective glass diameter	96mm
Applicable model	**MF D / MF-U D** Note: Size 2010 is used with stage adapter B Sizes 2017, 3017, and 4020 are used with stage adapter

Note: The V-block with Clamp, Swivel Center Support and Holder with Clamp can be mounted on the table.



V-block with Clamp	
Order No.	**172-378**
	Maximum clamping diameter: 25mm Height from the mounting surface to the center: 38 to 48mm
External dimensions (mm)	117(H)×90(W)×45(D)
Mass	0.8kg
Applicable model	**MF D / MF-U D** Note: Size 2010 is used with stage adapter B. Sizes 2017, 3017, and 4020 are usable with stage adapter

Swivel Center Support	
Order No.	**172-197**
	± 10° for swivel position Minimum angle index: 1° Suitable for measuring screws or other objects Maximum horizontal clamping size: ø80×140mm Maximum clamping size when inclined 10°: ø65×140mm
Mass	2.5kg
Applicable model	**MF D / MF-U D** Note: Size 2010 is used with stage adapter B. Sizes 2017, 3017, and 4020 are used with stage adapter



Holder with Clamp	
Order No.	**176-107**
Maximum clamp length (mm)	35
External dimensions (mm)	62(H)×152(W)×38(D)
Mass	0.4kg
Applicable model	**MF D / MF-U D** Note: Size 2010 is used with stage adapter B. Sizes 2017, 3017, and 4020 are usable with stage adapter

Stage Adapter / Stage Adapter B	
Order No.	**176-304** (for 2017, 3017, 4020) **B: 176-310** (for 2010)
External dimensions for one piece (mm)	50(W)×340(D)×15(H) Note: Adapter B is 280(D).
Mass	1.5kg / B: 1.2kg
Applicable model	**MF D / MF-U D**

Note: The two pieces are provided as one set.

Optional Accessories

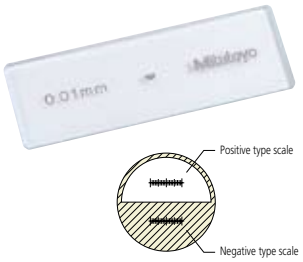
Polarization Unit	
Order No.	**378-092** (For both the bright-field model and the bright-field and dark-field model) Each polarizer/analyzer is provided as a one-piece set.
Applicable model	**MF-U D**

Differential Interference Contrast Unit	
Order No.	**378-080** (for 5X and 10X) **378-079** (for 20X) **378-078** (for 50X and SL20X) **378-076** (for 100X, SL80X, and SL50)
Applicable model	**MF-U D**

Note: Use this with a polarization unit.

Illumination Filter		
For halogen illumination for a microscope*	GIF filter	**12AAA645**
	LB80 filter	**12AAA646**
	ND2 filter	**12AAA643**
	ND8 filter	**12AAA644**
For a light source of reflected illumination (for 100 W fiber illumination)	GIF filter	**12AAG806**
	LB80 filter	**12AAG807**

*__MF D__ (for both transmitted illumination and reflected illumination), **MF-U D** (only for transmitted illumination)



Stage Micrometer	
Order No.	**375-056**
Scale length	1mm
Minimum graduation	0.01mm
Scale accuracy (20°C)	1+L(μm). L: length between any two lines (mm)
Scale	Negative type / Positive type
External dimensions (mm)	76(W)×26(D)
Mass	16g
Applicable model	**MF D/MF-U D**

Note: After purchasing the product, we perform calibration. For details, contact a sales office near you.

C-Mount Adapter	
Order No.	**970441**
	This standard adapter is used to mount a device such as a digital camera to the TV camera port of a microscope. Note: This is not used when the Vision Unit is mounted.
External dimensions (mm)	ø45×22.5(H)
Applicable model	**MF D / MF-U D**

0.5X TV Adapter (Including C-Mount Adapter)	
Order No.	**375-054**
	This standard adapter is used to mount a device such as a digital camera to the TV camera port of a microscope. This adapter enables observation with a wide field of view using a 0.5X minimum relay image. Magnification accuracy: ±0.1%, Image field diameter: 11mm Note: This adapter is included with the Vision Unit as standard.
External dimensions (mm)	ø45×123(H)
Applicable model	**MF D / MF-U D**

Mounting Stand (for Microscope)	
Order No.	**176-309**
Maximum loading	300kg
External dimensions (mm)	1200(W)×900(D)×650(H)
Mass	Approximately 50kg
Applicable model	**MF D / MF-U D**

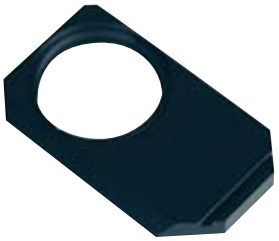
Note: When specifying a microscope with the Vision Unit, we recommend selecting the large mounting stand No. **02ATE760**, which has external dimensions of 1,800(W)×900(D)×740(H).

Vibration Damping Stand	
Order No.	**176-308**
Supporting method	Spring pad
Maximum loading	200kg
External dimensions (mm)	750(W)×550(D)×36(H)
Mass	36kg
Applicable model	**MF D / MF-U D**

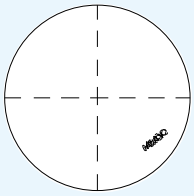
Mitutoyo

Optional Accessories
Reticles

For MF D



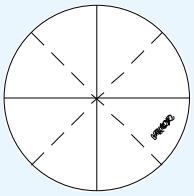
For MF-U D



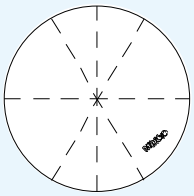
No.12AAG838 (MF D)
No.12AAG878 (MF-U D)
90° chain lines
Chain line pitch: 0.2 to 0.2
Line width: 7µm

No.12AAG836 (MF D)
No.12AAG877 (MF-U D)
90° chain line
Chain line pitch: 0.2 to 0.2
Line width: 5µm

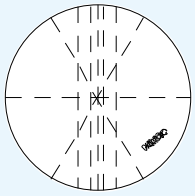
No.12AAG873 (MF D)
No.12AAG876 (MF-U D)
90° chain lines
Chain line pitch: 0.2 to 0.2
Line width: 3µm



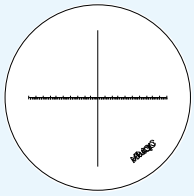
No.12AAG839
(MF C / MF D)
No.12AAG879
(MF-U D)
90° solid lines, 45° chain lines
Chain line pitch: 0.2 to 0.2
Line width: 5µm



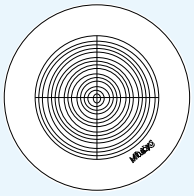
No.12AAG840
(MF C / MF D)
No.12AAG880
(MF-U D)
90° chain lines, 60° chain lines
Chain line pitch: 0.2 to 0.2
Line width: 5µm



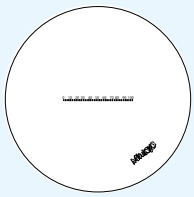
No.12AAG841
(MF C / MF D)
No.12AAG881
(MF-U D)
Zeiss type pattern
Chain line pitch: 0.2 to 0.2
Line width: 5µm



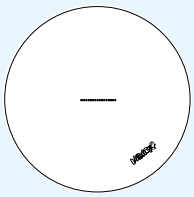
No.12AAG842
(MF D)*[1]
Cross haired graduation lines
0.1/20mm
Line width: 7µm



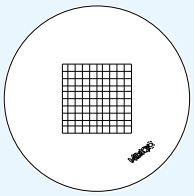
No.12AAG843
(MF D)*[1]
Concentric circles with
graduation lines
ø1.2 to ø18
Line width: 7µm



No.12AAG844
(MF D)*[1]
Graduation lines
0.1/10mm
Line width: 10µm

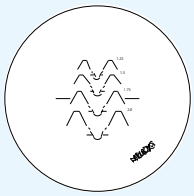


No.12AAG845
(MF D)*[1]
Graduation lines
0.05/5mm
Line width: 10µm



No.12AAG846
(MF D)*[1]
Grid lines
□ 1mm □ 10mm
Line width: 10µm

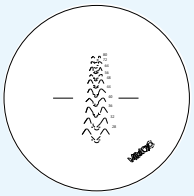
No.12AAG847
(MF D)*2
Metric coarse screw thread
p = 0.25 to 1.0
Line width: 7µm



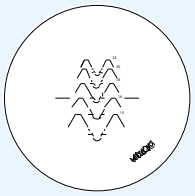
No.12AAG848
(MF D)*2
Metric coarse screw thread
p = 1.25 to 2.0
Line width: 7µm

No.12AAG849
(MF D)*2
Involute gear reference rack
m = 0.1 to 1.0, pressure angle: 14.5°
Line width: 7µm

No.12AAG850
(MF D)*2
Involute gear reference rack
m = 0.1 to 1.0, pressure angle: 20°
Line width: 7µm

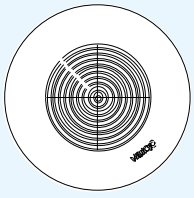


No.12AAG851
(MF D)*2
Unified coarse screw thread
80 to 28
Line width: 7µm



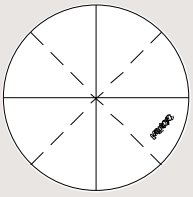
No.12AAG852
(MF D)*2
Unified coarse screw thread
24 to 14
Line width: 7µm

No.12AAG853
(MF D)*2
Unified coarse screw thread
13 to 10
Line width: 7µm



No.12AAG854
(MF D)*2
Concentric circles with cross hairs
0.01" to 0.20"
Line width: 7µm

Reticle for digital protractor eyepiece
(included as standard)



90° solid lines, 45° chain lines
Chain line pitch: 0.2 to 0.2
Line width: 7µm

Each reticle includes an attachment board.
*1. Use this with an eyepiece that has 10X magnification.
*2. This is the comparison chart specific to a 3X ML objective. Use this with an eyepiece that has 10X magnification.

120 1506 (3) B-(CH)HS, Printed in Japan

Coordinate Measuring Machines

Vision Measuring Systems

Form Measurement

Optical Measuring

Sensor Systems

Test Equipment and Seismometers

Digital Scale and DRO Systems

Small Tool Instruments and Data Management

Whatever your challenges are, Mitutoyo supports you from start to finish.

Mitutoyo is not only a manufacturer of top quality measuring products but one that also offers qualified support for the lifetime of the equipment, backed up by comprehensive services that ensure your staff can make the very best use of the investment.

Apart from the basics of calibration and repair, Mitutoyo offers product and metrology training, as well as IT support for the sophisticated software used in modern measuring technology. We can also design, build, test and deliver bespoke measuring solutions and even, if deemed cost-effective, take your critical measurement challenges in-house on a sub-contract basis.

Find additional product literature and our product catalogue

http://www.mitutoyo.co.jp/global.html

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